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The Douglas-fir/Pinegrass Habitat Type in Central Idaho: Succession and Management

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RESEARCH SUMMARY

A succession classification system for the Douglas-fir/pinegrass habitat type is presented. It is based on reconnaissance sampling of 167 stands: 44 old-growth sites, three pairs of old-growth versus disturbance sites, and 117 additional disturbed sites. A total of 10 potential tree layer types, 32 shrub layer types, and 60 herbaceous layer types are categorized by a hierarchical taxonomic classification. Diagnostic keys based on indicator species are provided for field identification of the layer types.

Implications for natural resource management are provided based on field data and observations. These implications include: occurrence of pocket gophers and success of tree plantations by site preparation treatments, initial growth rates of tree seedlings and yield capability of mature trees, microsite needs of natural tree seedlings, big-game and livestock forage preferences of shrub and herb layer types, and responses of major shrub and herb layer species to various disturbances. Species composition data for each of the sampled tree, shrub, and herb layer types are displayed in tables.

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INTRODUCTION

Because of the increasing and often conflicting demands on our natural resources, land managers need to predict changes in vegetation resulting from human activities. But many factors influence vegetal change. Often the integral of cause and effect as well as random, cyclic, and temporal relationships in vegetation dynamics are bewildering. A first step toward understanding the complexity of seral vegetation is to reduce the number of units by a classification.

Habitat type classifications focus on the environmental differences affecting vegetation. They provide a logical framework for studying succession and occasionally imply successional relationships, but do not classify seral communities. This classification of seral vegetation is designed for general field use. The natural classifications we use have broader application and often allow better predictions than technical classifications designed for a specific use. The widely accepted habitat type system of classification is an outstanding example of a natural classification. As its originators, R. and J. B. Daubenmire (1968), pointed out "... that system may be considered the closest to a natural one that allows the most predictions about a unit from a mere knowledge of its position in the system." We developed the following classification with these criteria in mind. The relative position of a classified unit in the system can help predict the successional status of that unit. We found that some types of seral vegetation result from a specific disturbance; other types develop mainly through uninterrupted succession. These cause-and-effect relationships are presented in sections dealing with classification and with management implications.

Vegetation is influenced by both time and environment. Environment, as it affects vegetation, can be delineated by habitat types or potential climax communities (Daubenmire 1952) that are relatively stable, barring disturbance. Time, as it relates to succession, can be delineated by community types or seral stages that can be obliterated, slightly altered, or advanced through various disturbances. Habitat type classifications have proven useful in much of the West (Layser 1974). By focusing on climax potential, they enable investigators to hold time constant while grouping plant communities according to their environment. Conversely, environment can be held relatively constant by focusing on one habitat type while studying vegetal dynamics over time.

This report explores the changes in vegetation and related resource values occurring over time in one forest environment, the *Pseudotsuga menziesii/ Calamagrostis rubescens* habitat type (PSME/CARU h.t.) (Steele and others 1981). Our classification approach recognizes the individual nature of specific sites in terms of existing and potential species composition. It also recognizes that land managers need site-specific guidelines for management. Management implications for many species can be derived from the species' successional strategy and reaction to a particular disturbance. This report can be applied to specific sites by combining knowledge of the successional characteristics for each major species either existing or potentially existing on a particular site. Sometimes, the preliminary nature and meager data base require managers to regard the information as no more than a tentative guide. Users should focus on the relative nature of data in this report, rather than the absolute values. Suggested revisions and other feedback from users are always welcome. Because this report was developed through a series of approximations, it will always be open to further refinement.

This report applies one concept for classifying seral vegetation (Steele 1984). It recognizes the somewhat independent nature of succession in the tree, shrub, and herbaceous layers (often due to layer-specific disturbances such as selective tree harvesting or grazing), treating these three successions separately. It recognizes the high potential diversity of early and midseral vegetation and the relative forage values to livestock and big game. It also indicates some of the relationships between site treatment, planted tree survival, competing vegetation, and pocket gopher populations. Perhaps most important, it provides a common framework for communication among various disciplines.

The objectives of this report are:

1. To develop a classification of seral plant community types in the PSME/CARU h.t. based on indicator species and vegetal structure.
2. To identify successional relationships of community types and relate these communities to the management treatments that gave rise to them.
3. To present species composition and canopy coverage information for each shrub and herbaceous layer sampled and its relative value as forage for big game and livestock.
4. To describe suitable conditions for natural and artificial establishment of tree seedlings and early growth characteristics of trees in relation to site treatment, microsite conditions, and competing vegetation.
5. To provide a basis for developing preliminary management implications by seral community type.

METHODS

This report is the fourth of a series on succession and management in forest habitat types. The methods are identical to those used previously. Method details are available in the earliest final report (Steele and Geier-Hayes 1987). In general, sampling methods were similar to those used in the central Idaho habitat type study (Steele and others 1981). Circular plots (375 m^2 in size) were subjectively located to represent the range of site conditions and vegetal diversity characteristic of the habitat type. Recorded observations included age of last disturbance, plant coverage by species, percent survival of planted tree seedlings, occurrence of pocket gopher mounds, snow damage to tree seedlings, methods of logging, slash disposal and site preparation, and thickness of duff layer. The plant coverage data were used to develop a succession classification (Steele 1984). They were later assembled in synthesis tables (Mueller-Dombois and Ellenberg 1974) to verify the early seral to climax arrangement of stands as indicated by the classification.

THE PSME/CARU HABITAT TYPE

In the Northern Rockies, PSME/CARU appears to be the most widely distributed habitat type in the *Pseudotsuga* series. It ranges from southern British Columbia (Brayshaw 1965) and eastern foothills of the Cascade Mountains in Washington (Daubenmire and Daubenmire 1968) to central Montana (Pfister and others 1977) and eastern Oregon (Hall 1973; Johnson and Simon 1987). It extends southward through Idaho, encroaching into adjacent Wyoming (Steele and others 1983) and barely reaching Utah in the Raft River Range (Mauk and Henderson 1984).

In central Idaho, PSME/CARU is widespread, although it is rare in the Lost River Range and the southern half of the Lemhi and Beaverhead Ranges. These areas have a pronounced continental climate, as indicated by the prevalence of *Pseudotsuga/Juniperus communis* and *Pseudotsuga/Arnica cordifolia* habitat types and a strong representation of *Pinus flexilis*. PSME/CARU is virtually absent in such areas, both in Idaho and Wyoming. It also becomes scarce wherever a strong maritime influence exists, as in northern Idaho and adjacent areas. Where PSME/CARU occurs in northern Idaho, contiguous cooler, wetter sites are commonly an *Abies lasiocarpa* habitat type with no intervening *Tsuga* series (Daubenmire and Daubenmire 1968), suggesting a locally diminished maritime effect. In central Idaho, PSME/CARU is most prevalent, and likely zonal, along the dry eastern periphery of maritime influence (fig.1). The environments immediately eastward are continental. Thus, PSME/CARU appears to have a maritime affinity, but is best represented where the maritime influence is greatly diminished.

Figure 1—Distribution of the PSME/CARU h.t., PIPO phase (•) and FEID (f) phase in central Idaho.

Table 1—Elevational range and important tree species in phases of the PSME/CARU h.t.

	Phase and elevational range (ft)					
Tree species	AGSP[1] 2,700–5,300	PIPO 3,500–6,600	ARUV[1,2] 2,300–5,400	CARU 4,700–7,900	PAMY 6,000–7,700	FEID 6,200–7,600
Pinus ponderosa	S[3]	S	S	.	.	.
Larix occidentalis	.	.	(S)	(s)	.	.
Pinus contorta	.	(S)	(S)	(S)	(S)	.
Populus tremuloides	.	(S)	.	(S)	(S)	.
Pseudotsuga menziesii	C	C	C	C	C	C

[1]From Pfister and others 1977.
[2]From Cooper and others 1991.
[3]S = major seral; s = minor seral; C = major climax; () = occurs in only part of the phase.

The PSME/CARU h.t. ranges in elevation from about 4,100 to 7,900 ft (1,250 to 2,408 m) in central Idaho, but may occur as low as 2,300 ft (701 m) in northern Idaho. This broad range is segmented elevationally and geographically by several phases. Elevational range and important seral trees of the various phases are shown in table 1.

Pinus ponderosa (PIPO) Phase

The PIPO phase ranges from Montana through central Idaho, extending into eastern Washington (table 2). It is found between 4,100 and 6,600 ft (1,250 and 2,012 m) in Idaho, mainly in the west-central portion (fig. 1). It extends as low as 3,500 ft (1,067 m) in Montana (Pfister and others 1977).

Table 2—Phase designations of PSME/CARU h.t. suggested by various studies

Phases	None	AGSP	PIPO	ARUV	CARU	PAMY	FEID
British Columbia:							
Tisdale and McLean 1957	([1])	.	.	.	.	.	.
Illingsworth and Arlidge 1960	([1])	.	.	([1])	.	.	.
Brayshaw 1965	X[2]	.	.	X	.	.	.
McLean 1970	X	.	.	0	.	.	.
Alberta:							
Ogilvie 1963	X	.	.	0	.	.	.
Stringer and LaRoi 1970	[1]	.	.	.	.	.	.
Montana:							
Pfister and others 1977	.	X	X	X	X	.	.
Northern Idaho and eastern Washington:							
Daubenmire and Daubenmire 1968	.	.	0	X	0	.	.
Cooper and others 1991	.	.	0	X	0	.	.
Lillybridge and Williams 1984	X	0	0	0	.	.	.
Eastern Oregon:							
Hall 1973	X	.	0	.	.	.	.
Johnson and Simon 1987	X	.	0	.	.	.	.
Central Idaho:							
Steele and others 1981	.	.	X	0	X	.	X
Eastern Idaho and western Wyoming:							
Cooper 1975	X	.	.	.	0	.	.
Steele and others 1983	.	.	.	.	X	X	.
Northern Utah:							
Mauk and Henderson 1984	X	.	.	.	0	.	.

[1]Apparently a PSME/LIBO h.t. or PSME/VACA h.t.
[2]X = phase defined; 0 = phase suggested by data or description.

This phase represents a warm, relatively productive segment of the habitat type. Consequently, it supports the greatest number of species and the greatest complexity of seral communities. Early seral conditions usually support few trees, but occasionally may include an open stand of *Populus tremuloides* or *Pinus contorta*. More often, scattered young *Pinus ponderosa* comprise the sparse tree layer. Seral shrubs are particularly evident in this phase. Their high coverages often obscure the climax potential of a *Calamagrostis* sward. Species and coverages are a direct consequence of the types of past disturbances and seed availability. *Purshia tridentata* (from scarification) and *Ceanothus velutinus* (from burning) indicate early seral conditions. They may vary from nearly pure coverage to major components of a diverse shrub layer. Certain herbs also characterize early seral conditions. *Iliamna rivularis* (from burning) and *Potentilla glandulosa* (from scarification) are common early seral indicators. Where grazing is limited, *Geranium viscosissimum* soon becomes an additional important component.

Mid to late seral stages may contain remnants of previous *Pinus contorta* or *Populus tremuloides* stands. The longer lived *Pinus ponderosa* is a major seral tree and often codominates the site with *Pseudotsuga*. The shrub layer, generated during earlier stages, declines beneath the trees. It is characterized by more persistent shrub species such as *Prunus virginiana*, *P. emarginata*, *Salix scouleriana*, and *Symphoricarpos oreophilus*. None of these persist indefinitely beneath a climax tree canopy. The undergrowth gradually shifts from shrubby to herbaceous. In the herbaceous layer, *Calamagrostis* may be accompanied by conspicuous amounts of *Carex geyeri*, *Poa nervosa*, *Arnica cordifolia*, *Aster conspicuus*, *Fragaria* spp., or *Apocynum androsaemifolium*. The relative amounts of these species reflect the nature and intensity of past disturbance.

In climax to near-climax condition, *Pseudotsuga* is the dominant tree. The open nature of the stand greatly prolongs *Pinus ponderosa*. Shrub layers are depauperate or nonexistent. *Calamagrostis*, followed closely by *Arnica*, is most successful beneath the tree canopy, creating a sward that is characteristic of the habitat type.

Figure 2—Distribution of the PSME/CARU h.t., CARU phase in central Idaho.

Calamagrostis rubescens **(CARU) Phase**

The CARU phase is common near the Idaho-Wyoming border, in east-central Idaho, and across much of Montana. From east-central Idaho, it occurs westward sporadically at elevations above the limits of *Pinus ponderosa* (fig. 2) and likely extends into northern Idaho (table 2). It ranges in elevation from about 6,400 to 7,900 ft (1,951 to 2,408 m) in Idaho and occurs as low as 4,700 ft (1,433 m) in Montana (Pfister and others 1977).

Productivity of both timber and browse is less than in the PIPO phase. *Pinus contorta* is usually the major seral tree, but *Populus tremuloides* may be present. In northwestern Montana and in British Columbia where this phase also occurs, *Larix occidentalis* may occupy disturbed sites. A less diverse and often poorly developed shrub layer reflects the cooler temperatures of this phase. *Artemisia tridentata* ssp. *vaseyana* and *Chrysothamnus* invade bare soil exposed by burning or scarification. *Ceanothus velutinus* germinates from buried seed following burning, but attains appreciable coverage only at the lower, warmer extremes of the range of this phase. *Ribes cereum* also germinates from buried seed and may be the dominant shrub on scarified sites. These shrubs indicate early seral conditions, yet they rarely achieve densities comparable to the PIPO phase. Early seral herbaceous layers may be diverse, though seldom luxuriant. *Potentilla glandulosa*, and on the cooler sites, *Carex rossii*, respond to scarification. On soil exposed by scarification or burning, *Antennaria microphylla* can become an important species. *Bromus carinatus* may increase on

ungrazed sites. However, severe disturbance is necessary before these species can dominate the ubiquitous *Calamagrostis*.

Mid to late seral conditions are considerably less complex than for the PIPO phase. *Pinus contorta* persists in a tree layer that is predominantly *Pseudotsuga*. Midseral shrubs other than *Symphoricarpos oreophilus* are usually sparse. Except for *Lupinus*, *Fragaria*, and the climax *Arnica*, the herbaceous layer is primarily graminoids. *Carex geyeri* and *Poa nervosa* are characteristic midseral graminoids among the *Calamagrostis*.

These communities are notably simple in climax to near-climax condition. A pure stand of multiage *Pseudotsuga* dominates the site. Shrubs are nil. *Calamagrostis*, often accompanied by *Arnica*, prevails in the undergrowth; other species are sparse and usually declining.

Festuca idahoensis (FEID) Phase

The FEID phase occurs mainly along the eastern periphery of central Idaho (fig. 1) from about 6,200 to 7,600 ft (1,890 to 2,316 m) elevation. It represents a broad transition to adjacent drier conditions where *Festuca* is the climax dominant grass. Consequently, timber and browse productivity is lower in this phase than in the CARU phase. Early seral conditions resemble adjacent sage-grass communities more than forested sites.

Limited sample data show *Artemisia tridentata* ssp. *vaseyana* to be the primary early seral shrub. This shrub will establish on bare soil exposed by burning or scarification. The herb, *Antennaria microphylla*, does so too. Few shrubs are present to indicate midseral conditions. The likely seral trees, *Pinus contorta* and *Populus tremuloides*, seldom become dense enough to affect the undergrowth. Instead, *Pseudotsuga* gradually shades out the *Artemisia*, leaving *Symphoricarpos oreophilus* as the primary midseral shrub component. Likewise, the herbaceous layer supports few species characteristic of midseral conditions. Apparently, *Calamagrostis* and *Festuca* simply increase at the expense of *Antennaria*. Climax to near-climax conditions support a multiage stand of *Pseudotsuga* beneath which *Calamagrostis* and *Festuca* are the major components.

Pachistima myrsinites (PAMY) Phase

The PAMY phase is found in eastern Idaho and adjacent Wyoming from about 6,000 to 7,700 ft (1,829 to 2,347 m) elevation (Steele and others 1983). A layer of *Pachistima* is characteristic of old-growth stands. Either *Pinus contorta* or *Populus tremuloides* may dominate seral stands, although neither species necessarily occupies all sites.

A layer of *Prunus virginiana* and *Symphoricarpos oreophilus* is a common seral characteristic. Successional features of this phase have not been studied.

Agropyron spicatum (AGSP) Phase

This phase occurs in Montana (table 2) where it ranges from 2,700 to 5,300 ft (823 to 1,615 m). Eventually, it may be found in Idaho. Like the FEID phase, it represents a transition to sites where bunchgrass dominates the herbaceous layer. The AGSP phase represents a warmer, more moderate condition than the FEID phase, as evidenced by the consistent presence of *Pinus ponderosa*. Succession in the AGSP phase has not been studied.

Arctostaphylos uva-ursi (ARUV) Phase

A condition described as the ARUV phase extends from British Columbia to central Montana, ranging from about 2,300 to 5,400 ft (701 to 1,646 m) (table 2). Though undescribed for central Idaho, it occurs along tributaries of the Salmon River with a distribution apparently centering in the largely unsampled Idaho Primitive Area. It also occurs locally in the Payette River drainage.

In terms of central Idaho habitat type classification (Steele and others 1981), the ARUV phase as delineated by Pfister and others (1977) is simply that portion of the PIPO phase capable of supporting *Pinus contorta* where *Arctostaphylos* is common. Their delineation follows the Daubenmires' (1968), which apparently was influenced by earlier studies in Canada that employed a rather broad concept of the *Pseudotsuga/Calamagrostis* association (Brayshaw 1965; Illingsworth and Arlidge 1960; Ogilvie 1963; Tisdale and McLean 1957). *Arctostaphylos*, however, can achieve significant coverage with *Calamagrostis* beyond both the dry limits of *Pinus contorta* and the cold limits of *P. ponderosa*. *Arctostaphylos* is most successful on gentle slopes and benchlike terrain, often consisting of depositional material. In the *Pseudotsuga* series, this terrain is nearly identical to that of the *Pseudotsuga menziesii/Vaccinium caespitosum* h.t. (Pfister and others 1977; Steele and others 1981), which normally supports *Arctostaphylos*, *Calamagrostis*, *Pinus contorta*, and *P. ponderosa*. In fact, the earlier Canadian studies included *Vaccinium caespitosum* (with *Arctostaphylos*) in their PSME/CARU or PSME/CARU-ARUV unit. One of the Daubenmires' (1968) four sampled stands designated as the ARUV phase also contained *V. caespitosum*.

In areas where *Arctostaphylos* occurs extensively, its environmental relationship with *Vaccinium caespitosum* and *Calamagrostis rubescens* may be obscure, especially on gentle terrain. In the steep

terrain of central Idaho, however, *Arctostaphylos* is more restricted and its environmental affinities are more evident. *Arctostaphylos* is clearly associated with frost-prone areas and cold air channels, but does not necessarily occur where the most cold air is trapped. These sites are typically occupied by *Vaccinium caespitosum*. *Arctostaphylos* is abundant where less cold air accumulates, continuing upslope until the frost pocket effect is greatly diminished. *Calamagrostis,* which occurs with both the *Vaccinium* and *Arctostaphylos,* continues upslope well beyond the influence of cold air impoundment. It appears that the ARUV phase is intermediate between PSME/VACA and PSME/CARU, but is more closely related to the cold air influences of the PSME/VACA h.t.

Successional features of the ARUV phase have not been studied, but it is clear that *Pinus contorta* is a common early seral dominant followed by *P. ponderosa*. In parts of northern Idaho (Cooper and others 1991) and northwestern Montana (Pfister and others 1977), *Larix occidentalis* may also occur on these sites. The seral shrub *Shepherdia canadensis* may be more frequent here than in the CARU or PIPO phases.

SUCCESSIONAL FEATURES

Successional Classification

A systematic classification of seral vegetation within the PSME/CARU h.t. was developed as part of this study. The basic approach (Steele 1984) was to recognize the two primary factors affecting vegetal change: time and environment. Environmental variation has been categorized by the habitat type classification system (Steele and others 1981). The habitat type system uses indicator species according to their ability to dominate or at least maintain their population at climax. The relative value of a species as an environmental indicator is inversely related to that species' relative environmental amplitude. In other words, species with the most restricted environmental distributions on a particular site are the best indicators of that particular habitat.

Temporal (successional) variation within habitat types can be categorized by a similar system that uses indicator species according to their ability to dominate a seral stage. This system of classification depends on a species' relative successional amplitude (competitive ability), which is inversely related to its value as an indicator. In other words, the species with the least competitive ability is the best indicator of a specific successional condition. Seral indicator species in a given habitat type can be arranged along the successional gradient according to their relative successional amplitudes. Figure 3 shows this arrangement for the major tree species

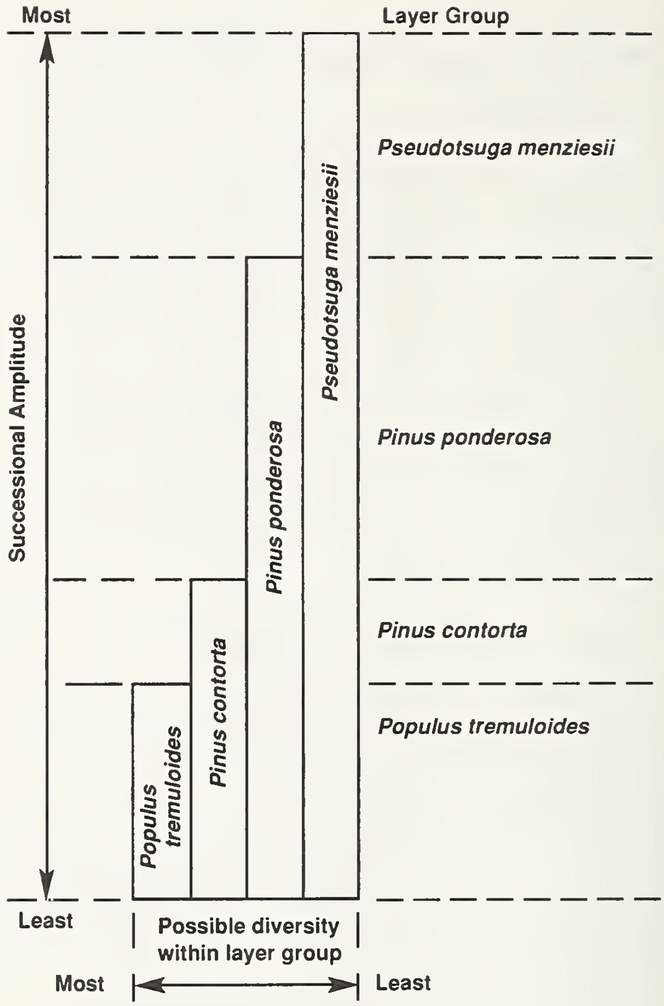

Figure 3—Relative successional amplitudes of major tree species in the PSME/CARU h.t.

in PSME/CARU. These indicators are then combined with possible dominant tree species to provide a temporal-structural framework for classifying seral tree layers. Figure 4 shows the classification framework derived from figure 3. Shade tolerance is often assumed to be the factor that determines successional amplitude, especially in the tree layer. But, as Minore (1979) suggests, other factors may be involved. Bazzaz (1979) addresses numerous physiological factors that affect a plant's ability to compete with its associates. Species longevity, light quality and nutrient requirements, resistance to disease and allelopathy, and reproductive strategy are some of the factors involved. Fortunately, the effects of all competitive factors, whether known or unknown, can be interpreted through relative successional amplitudes. These in turn, provide a successional time scale for classification. Chronological age is not as useful to classify seral communities, because of the random combinations of successional

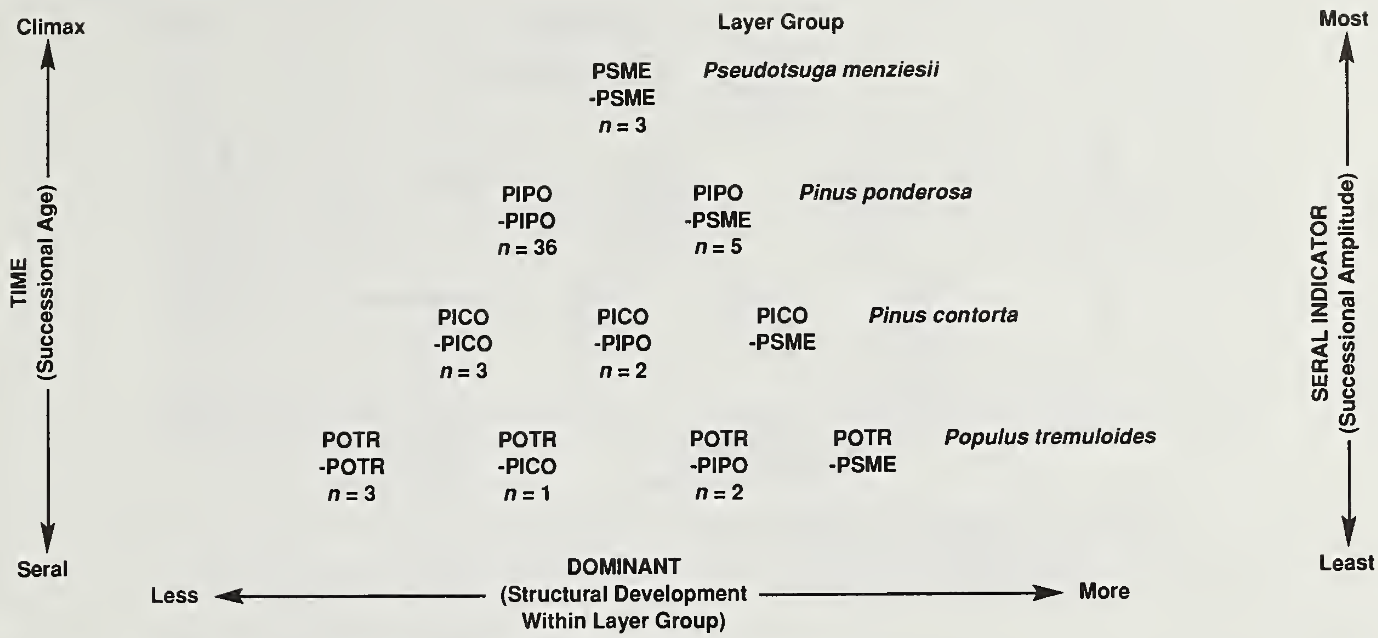

Figure 4—Succession classification diagram of the tree layer in the PSME/CARU h.t., PIPO phase (*n* = number of samples).

forces such as seed crops, insects, disease, and weather.

The Tree Layer

Because succession in the tree, shrub, and herb layers occurs at different rates and may be affected by different layer-specific disturbances, each layer is classified separately. The tree layer includes trees over 4.5 ft (1.4 m) tall. In PSME/CARU, the tree layer is relatively simple to classify since it contains only four major species. The relative successional amplitudes of these species are shown in figure 3. *Populus tremuloides* is clearly less tolerant than the associated conifers. *Pinus contorta* apparently has less amplitude than *P. ponderosa*. Although *P. contorta* is more shade tolerant than *P. ponderosa* (Minore 1979), it has a shorter lifespan and does not grow as tall. Thus, *P. contorta* is not likely to maintain itself beneath *P. ponderosa* without disturbance to reduce the young *Pseudotsuga* that will accumulate in the understory. Nor will *Pinus ponderosa* seedlings survive beneath the denser canopy of *Pseudotsuga*. The decline of the older pines in the stand delineates another successional segment. *Pseudotsuga* has the greatest successional amplitude and acts as the climax tree since it is the most shade tolerant. Although various factors often preclude the full succession potential, the relative successional amplitudes have been established for classification purposes.

Figure 3 suggests that species richness of the tree layer may be greatest in the early seral stages. All four species could be present on the site, although this is not usually the case. In the climax stage, only *Pseudotsuga* will be well represented. All other tree species will be poorly represented or absent. The diminishing number of species during secondary succession is more apparent in the shrub and herb layers, where more species occur.

Figure 4 shows the various seral conditions in the tree layer that may converge to a common climax community of *Pseudotsuga*. *Populus tremuloides* forms the base of the triangle because it has the least successional amplitude. Other species are arranged in ascending order as a reflection of their progressively greater successional amplitudes.

Each unit in figure 4 is called a layer type. Each group of layer types having the same seral indicator is called a layer group. Layer groups denote the various seral stages that are possible within a given habitat type or phase. Layer types within one layer group, such as PIPO-PIPO and PIPO-PSME in the PIPO layer group, denote the structural conditions that are possible in that seral stage. The trees may be naturally established, or they may be in plantations that usually result in a predictable layer type, such as PIPO-PIPO. Similar classifications were developed for the shrub and herb layers. If desired, the taxonomy of the tree, shrub, and herb layers can be combined to characterize the entire plant community.

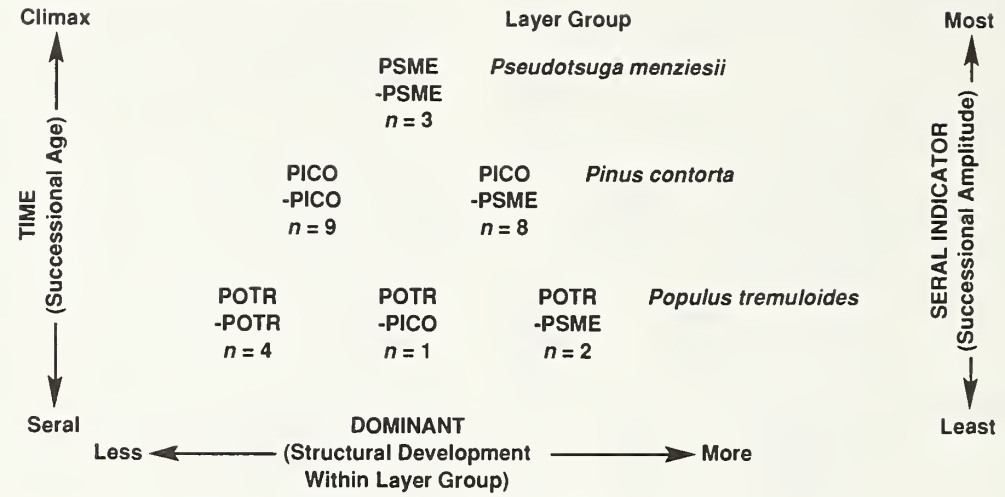

Figure 5—Succession classification diagram of the tree layer in the PSME/CARU h.t., CARU phase (*n* = number of samples).

Delineating the vertical axis (time) into layer groups (fig. 4) provides an ecological basis for segmenting the succession over time. As time passes, a stand's classification status may progress from one layer group to a successionally older layer group. For instance, *Pinus ponderosa* may dominate the tree layer (PIPO-PIPO), or may be dominated by *Pseudotsuga* (PIPO-PSME). But its presence can always be interpreted as a specific segment of the succession because the potential to be replaced by *Pseudotsuga* always exists. *Pinus ponderosa* is unable to replace *Pseudotsuga* without disturbance, but it can always outcompete *Pinus contorta* or *Populus tremuloides* in the PSME/CARU h.t.

Figures 4, 5, and 6 serve as **classification diagrams** (not succession models) for seral tree layers in the PSME/CARU h.t. These diagrams do not outline actual successions for a given site, but illustrate the possibilities within the habitat type. Actual successions may skip many layer types and even layer groups. A succession can be described in terms of the layer types shown, but it is determined by the stand's species composition and available seed sources.

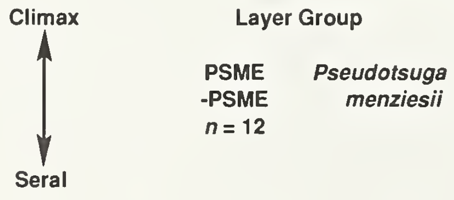

Figure 6—Succession classification diagram of the tree layer in the PSME/CARU h.t., FEID phase (*n* = number of samples).

Figures 4 and 5 also are the basis for a simple field key to tree layer types. It was constructed starting with the earliest layer group in figures 4 and 5 and progressing along the time gradient to climax (table 3). Keys to the shrub and herb layer types are constructed the same way. These keys are intended to be used in the same manner as the habitat type keys (Pfister and others 1977; Steele and others 1981).

SIZE CLASS NOTATIONS

The basic classification approach used in the tree, shrub, and herb layers was presented in figures 4 and 5 and table 3. The tree layer progresses through recognizable size classes, such as sapling (0.1-4 inches [0.25-10.2 cm] d.b.h.), pole (4-12 inches, 10.2-30.5 cm), mature (12-18 inches, 30.5-45.7 cm), and old (>18 inches, 45.7 cm). These notations should be added to each tree species after the tree layer type (l.t.) is identified, such as mature PIPO-sapling PSME l.t. For consistency, the smallest size class that is well represented should be noted for the successional indicator, because it reflects regeneration capability. For the dominant species, the dominant size class should be used. When the indicator species is well represented in the stand, but not in any one size class, or when the dominant species does not have a dominant size class, the size class with the most coverage should be noted. For convenience, size class notations can be abbreviated as follows: s. – sapling; p. – pole; m. – mature; and o. – old.

It may be difficult to visualize some tree layer types in their appropriate successional position. For instance, an s. PSME – s. PSME l.t. may not seem successionally older than an m. PICO – s. PSME l.t. We have a tendency to perceive large trees as more

Table 3—Key to tree layer groups and layer types, with code numbers, in the PSME/CARU h.t.

		Code No.
1. *Populus tremuloides* well represented[1]	POTR LAYER GROUP	014
1a. *Populus tremuloides* dominant	POTR-POTR Layer Type	014.014
1b. *Pinus contorta* dominant or codominant	POTR-PICO Layer Type	014.010
1c. *Pinus ponderosa* dominant or codominant	POTR-PIPO Layer Type	014.013
1d. *Pseudotsuga menziesii* dominant or codominant	POTR-PSME Layer Type	014.016
1. *P. tremuloides* poorly represented	2	
2. *Pinus contorta* well represented	PICO LAYER GROUP	010
2a. *Pinus contorta* dominant	PICO-PICO Layer Type	010.010
2b. *Pinus ponderosa* dominant or codominant	PICO-PIPO Layer Type	010.013
2c. *Pseudotsuga menziesii* dominant or codominant	PICO-PSME Layer Type	010.016
2. *P. contorta* poorly represented	3	
3. *Pinus ponderosa* well represented	PIPO LAYER GROUP	013
3a. *Pinus ponderosa* dominant	PIPO-PIPO Layer Type	013.013
3b. *Pseudotsuga menziesii* dominant or codominant	PIPO-PSME Layer Type	013.016
3. *P. ponderosa* poorly represented	4	
4. *Pseudotsuga menziesii* well represented	PSME LAYER GROUP	016
4a. *Pseudotsuga menziesii* dominant	PSME-PSME Layer Type	016.016
4. *P. menziesii* poorly represented	depauperate or undescribed tree layer or not PSME/CARU h.t.	

[1]"Well represented" means canopy coverage ≥5 percent, regardless of diameter classes of the trees involved. Trees less than 4½ feet (1.4 m) tall should be omitted from coverage estimates. "Dominant" refers to greatest canopy coverage, "codominant" refers to nearly equal canopy coverage. When keying to layer type, choose the first condition that fits.

advanced successionally than small trees. On a successional scale, however, a pure stand of sapling *Pseudotsuga* is closer to climax than a mixed stand of larger *Pinus contorta* and *Pseudotsuga*, because the pure stand will not go through the earlier successional stages of the PICO and PIPO layer groups. In fact, an s. PSME – s. PSME l.t. may reach climax more quickly, because no species replacement (succession) is needed. An m. PICO – s. PSME l.t. must first lose the *Pinus contorta*. If *Pinus ponderosa* is well represented, it must also pass through a PIPO-PSME l.t. before reaching climax.

The four possible tree layer groups in PSME/CARU (figs. 4, 5) delineate tree layer succession into relatively broad segments. Because layer group delineations are usually based on a single species, their origin can be related to a somewhat consistent set of site conditions. But progression from one layer group to another (and one layer type to another) depends on the species composition of the individual stand. Therefore, progression is predictable only for an individual stand, based on field observation or sample plot data. The following layer group descriptions are presented in the order they appear in the key (table 3). Constancy and average coverage of species within sampled layer types appear in appendix A.

POPULUS TREMULOIDES LAYER GROUP (POTR L.G.)

Populus tremuloides can establish by seed on newly exposed mineral soil that remains moist during the critical germination period. Viability of freshly fallen seed usually exceeds 90 percent, but only lasts about 3 weeks (Brinkman and Roe 1975). Occasionally, we find *Populus* seedlings established in well-scarified areas, some nearly as dry as PSME/CARU. Usually the young trees occur as root sprouts following fire or logging. Some may have encroached onto PSME/CARU sites from adjacent moister areas. On many of these sites, the *Populus* appears unthrifty, even in full sunlight. The sites may seem to be marginal for good *Populus* development (fig. 7). But when large *Populus* are present, top-killed trees can produce numerous root sprouts in full sunlight, providing ample browse for deer and elk.

The POTR l.g. occurs sporadically throughout the CARU phase. In the PIPO phase it occurs mainly at the upper extremes, usually above 6,000 ft (1,829 m). When it occurs below 6,000 ft (1,829 m), the sites are usually in a frost pocket. The POTR l.g. consists of four layer types in PSME/CARU (figs. 4, 5), all of which were found in either the PIPO or CARU phase. These layer types usually result from resprouting of

Figure 7—A sapling POTR-pole POTR tree layer type southwest of Idaho City, ID, in 1986. This area experienced a stand-destroying wildfire in about 1889. *Populus tremuloides* has dominated the site since then. Heavy sheep use that has occurred repeatedly may have contributed to the slow establishment of conifers.

scattered, often decadent *Populus* following overstory removal by wildfire or logging. When *Populus* is present in the stand and no conifers establish soon after disturbance, a POTR-POTR layer type can result. In this layer type, subsequent invasion by conifers may be slow even when seed sources are nearby. The reason is unclear, but Younger, Koch, and Kapustka (1980) have shown that *Populus tremuloides* leaf litter can chemically inhibit seedling growth of several grasses. Conifer seedlings may also be affected. Since the POTR-POTR layer type creates only light shade, it allows continued development of the herbaceous layer that may also hinder conifer establishment. Simultaneous establishment of *Pinus contorta*, *P. ponderosa*, or *Pseudotsuga* with the resprouting of scattered *Populus* can produce a POTR-PICO, POTR-PIPO, or POTR-PSME layer type. These can progress to a PIPO or PSME layer group more quickly than the POTR-POTR layer type.

PINUS CONTORTA LAYER GROUP (PICO L.G.)

Pinus contorta is common in cooler portions of PSME/CARU, particularly in the CARU phase. Many of the sites where it occurs, especially those at the lower elevations, represent frost pockets. These sites are usually found on gentle terrain and lower slopes. In PSME/CARU, a dominant cover of *Pinus contorta* usually indicates frost potential well above average. *Pinus contorta* is often planted successfully in these frost-prone areas. But some plantations extend upslope beyond the cold air zone. These "offsite" seedlings may survive, but are not likely to produce much timber. They can shelter *Pseudotsuga* seedlings, hastening reforestation.

Although *Pinus contorta* is considered more shade tolerant than *P. ponderosa* (Minore 1979), the PICO layer group represents an earlier successional stage due to the shorter life span of *P. contorta* (Minore 1979). In PSME/CARU, the PICO layer group consists of three layer types in the PIPO phase (fig. 4) and two in the CARU phase (fig. 5), where it is more common. Historically, PICO layer types resulted from stand-destroying wildfire. More recently, clearcuts with burning or scarification treatments have produced PICO layer types wherever seed is retained. The short-lived nature of *P. contorta* causes PICO layer types to be replaced in a relatively short time. Succession is mainly toward the PSME layer group, occuring within one generation of *P. contorta*. Two or more generations of *P. contorta* may occur before succession progresses to a PSME layer type in the more severe frost pockets.

PINUS PONDEROSA LAYER GROUP (PIPO L.G.)

By definition, *Pinus ponderosa* occurs throughout the PIPO phase of PSME/CARU. Unless planted offsite, it is absent in the CARU and FEID phases. *P. ponderosa* is the only major seral species that occurs throughout the PIPO phase, yet it is slow to colonize disturbed areas. Infrequent cone crops and poor dispersion of the heavy seed are major reasons pine doesn't become widely established. Unsuitable seedbeds are also a contributing factor. Logging and broadcast burning stimulate several shrub and herb layer species, which can quickly dominate potential pine seedbeds. As a result, natural establishment of *P. ponderosa* is often slow and sporadic, especially in large clearcuts. Yet pine can regenerate over time in bare mineral soil beneath a partial canopy of seed-producing pine. In PSME/CARU, seedling establishment may depend on the coincidence of adequate seed, above-normal moisture, and a suitable seedbed. Before fire control, frequent low-intensity fires provided suitable seedbeds on a regular basis. Recruitment of young pines may have been more common.

The PIPO l.g. consists of two layer types in PSME/CARU (fig. 4). The relative seral position of these layer types show them to be midseral, even though they are often the initial tree layer on a site. In these cases the early seral species, *Populus tremuloides* and *Pinus contorta,* are absent. Under natural conditions in PSME/CARU, PIPO layer types develop slowly and are quite persistent, which is characteristic of midseral vegetation.

The PIPO-PIPO layer type is widespread in the PSME/CARU h.t., PIPO phase. Historically, it resulted from frequent underburning. More recently, it has resulted from pine plantations. Without special site preparation, the stands are likely to be poorly stocked. The PIPO-PSME layer type is much less common than PIPO-PIPO. It usually indicates stands that have not underburned for at least 50 years. In some of these stands, selective cutting of the pine can quickly advance succession to the PSME l.g., increasing fire, insect, and disease hazards.

PSEUDOTSUGA MENZIESII LAYER GROUP (PSME L.G.)

Pseudotsuga is the only tree species that occurs throughout the PSME/CARU h.t. However, *Pseudotsuga* establishment is slow and sporadic. Most seedlings occur in the protected microsites created by rocks and logs or shrub and tree canopies. Successful plantations of *Pseudotsuga* are uncommon in PSME/CARU, but natural regeneration is being achieved through shelterwood systems where the pinegrass sod is well scarified.

Since the PSME l.g. is climax, it consists of only one layer type, PSME-PSME. Though rare in the PIPO phase, the PSME-PSME layer type is quite common in the CARU and FEID phases. Here it is often the only tree layer occurring naturally. It may be in sapling, pole, mature, and old size classes, or in combinations. Uninterrupted succession or cutting practices that leave only *Pseudotsuga* in the stand can produce the PSME-PSME layer type. PSME-PSME has the greatest potential of any of the tree layer types for catastrophic fire, insects (spruce budworm), and disease (dwarf mistletoe).

The Shrub Layer

Succession in the shrub layer of PSME/CARU is less diverse than in other habitat types, such as Douglas-fir/ninebark, or the grand fir series. This is partly due to the more severe environment and partly due to the lack of a climax shrub layer. Table 4 lists the major shrub species in PSME/CARU. *Symphoricarpos*

Table 4—Successional roles of major shrub species in phases of the PSME/CARU h.t.

Code No.	Shrub layer species	Abbreviation	Phase		
			PIPO	CARU	FEID
105	*Amelanchier alnifolia*	AMAL	LS[1]	(ls)	—
150	*Artemisia tridentata*	ARTR	a	ES	ES
107	*Ceanothus velutinus*	CEVE	ES	(ES)	—
108	*Chrysothamnus nauseosus*	CHNA	a	ES	ES
152	*Chrysothamnus viscidiflorus*	CHVI	—	es	ES
123	*Prunus emarginata*	PREM	(MS)	—	—
124	*Prunus virginiana*	PRVI	MS	(ms)	—
125	*Purshia tridentata*	PUTR	ES	(ES)	(es)
128	*Ribes cereum*	RICE	ES	ES	(ES)
131	*Ribes viscosissimum*	RIVI	es	(ES)	a
137	*Salix scouleriana*	SASC	MS	ms	a
163	*Symphoricarpos oreophilus*	SYOR	LS	LS	LS

[1]ES = early seral; MS = midseral; LS = late seral; C = climax; a = accidental; upper case letters = major cover species; lower case letters = minor cover species; ( ) = occurs in only part of phase.

oreophilus and *Amelanchier* are the most persistent. Owing to their moderate shade tolerance and lack of vegetative reproduction, they cannot maintain their coverage beneath a climax tree canopy. Consequently, as these shrubs decline, *Calamagrostis* becomes the dominant undergrowth species. *Calamagrostis* must be added to the shrub layer classification to separate newly developed shrub layers from near-climax shrub layers being replaced by *Calamagrostis*.

Fifty shrub layers were sampled in the PSME/CARU h.t., PIPO phase, and 38 were sampled in the CARU phase. These stands have eight major indicator species and three alternates. The alternate species may occur only in part of the habitat type or may supplement another species that can grow throughout the habitat type. In either case, species are grouped according to similar ecological amplitudes and successional strategies. For instance, *Ribes viscosissimum* was grouped with *R. cereum*, since both species have seeds that store in the ground and respond to scarification. *Chrysothamnus* was grouped with *Artemisia* because both species have wind-dispersed seed, are nonrhizomatous, and are intolerant of shade.

The relative successional amplitudes of major shrub species in PMSE/CARU provide the basis for shrub layer classification (fig. 8). These amplitudes were derived from many field observations and

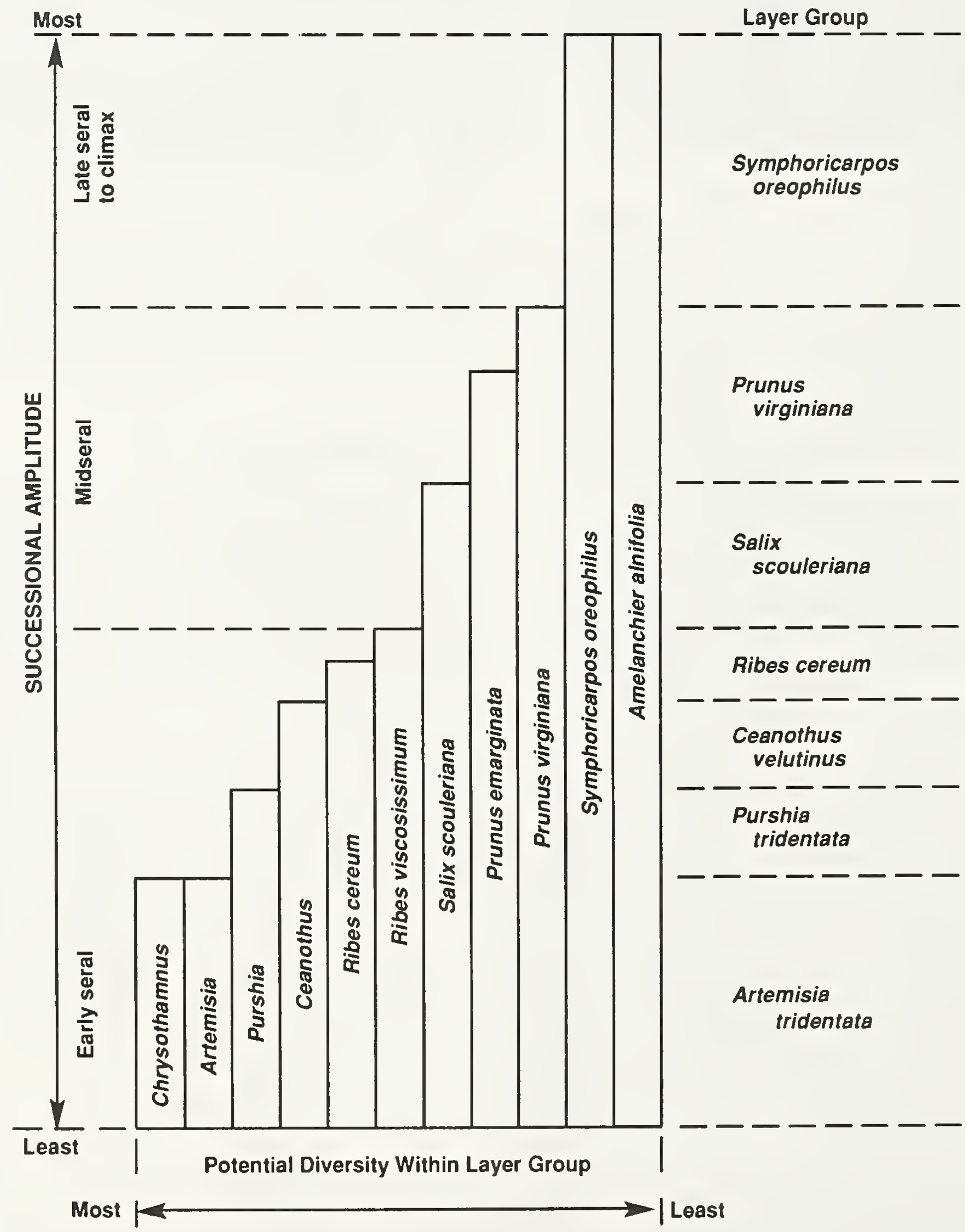

Figure 8—Relative successional amplitudes of major shrub species in the PSME/CARU h.t.

sample data (appendix A). They are meaningful only in a relative sense. Ideally, relative amplitudes (fig. 8) should be established through long-term studies of many permanent plots. Such studies are rarely attempted. The accuracy of the relative amplitudes in this study varies from well-established trends (as in the tree layer) to the authors' best guess. Accuracy is greatest for the species farthest apart. *Ceanothus* and *Artemisia* clearly have less successional amplitude than *Symphoricarpos*, but the relative amplitude of *Prunus* compared to *Salix* is less certain. We determined relative amplitudes using the "philosophy of successive approximations" (Poore 1962) as a scientific basis. We developed hypotheses for each species that were tested through field observation and data analysis.

Succession classification diagrams for the shrub layer are easily derived from the relative amplitudes (fig. 8). The entire classification for the PIPO phase consists of six shrub layer groups and 27 layer types (fig. 9). The CARU phase has four shrub layer groups and 14 layer types (fig. 10). The depauperate FEID phase has only two shrub layer groups and five layer types (fig. 11). Many of the layer types were encountered during reconnaissance sampling. The remaining layer types may be found with more sampling, may appear only after uncommon disturbances (or combinations of disturbance), or may be rare under any circumstances.

The classification diagrams are easily converted to a systematic key for field use (table 5). Layer group indicator species appearing early in the key have the least successional amplitude. They have greater indicator value than species with more amplitude that appear later in the key. This same ranking of indicator value is used to select the dominant indicator for layer types when several species codominate. Alternate indicator species appear with their appropriate primary indicator throughout the key (table 5).

The range of years since disturbance of sampled layer types appears in appendix A; averages are given when three or more known ages exist per layer type. The low extreme of each range is meaningless since any layer type could have been recently disturbed; in these cases only disturbance intensity would vary between layer types. The averages and upper extremes show a gradual though sporadic increase with successionally older layer types. This general progression of both years and layer types demonstrates that while both delineate time, they do so differently. However, years since the last disturbance can be misleading since some shrub layers

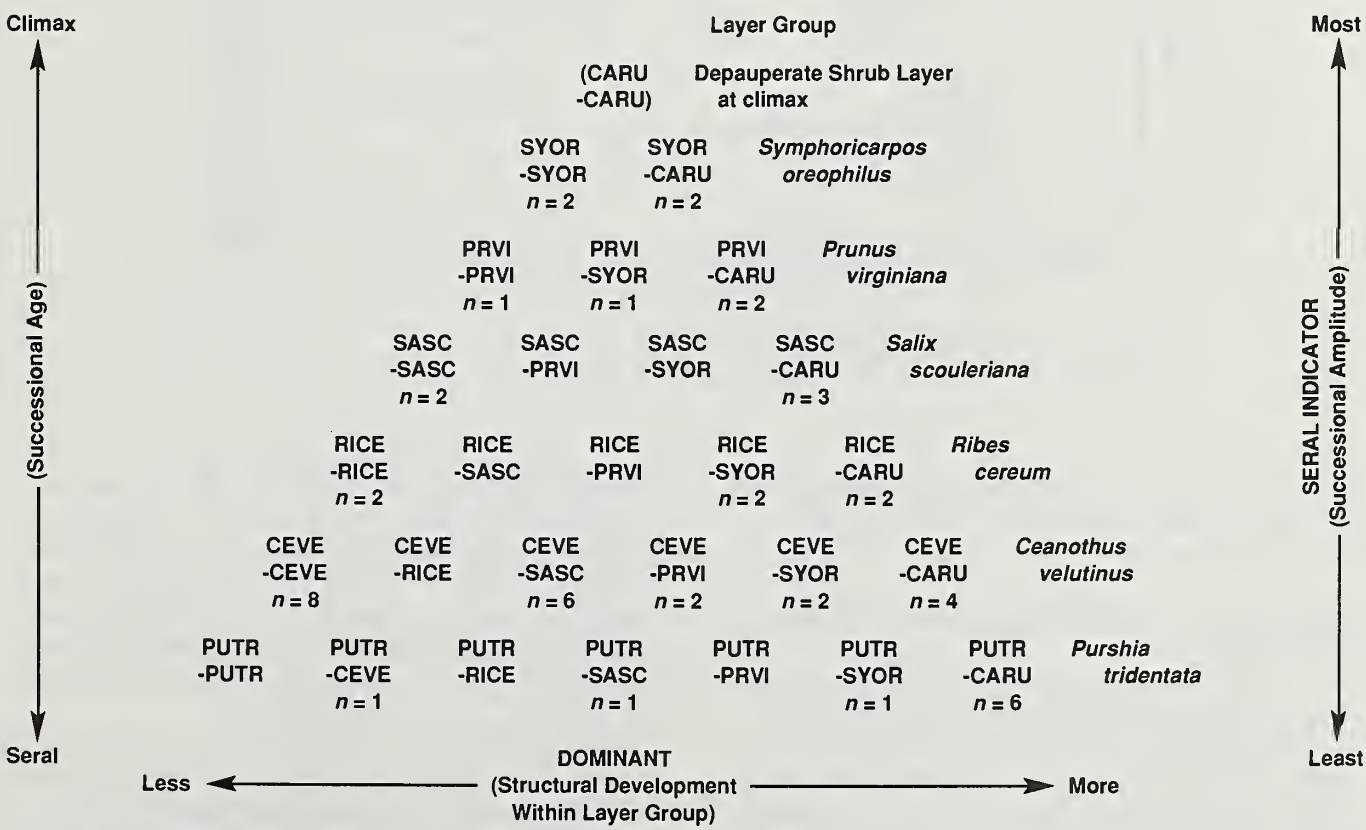

Figure 9—Succession classification diagram of the shrub layer in the PSME/CARU h.t., PIPO phase (*n* = number of samples).

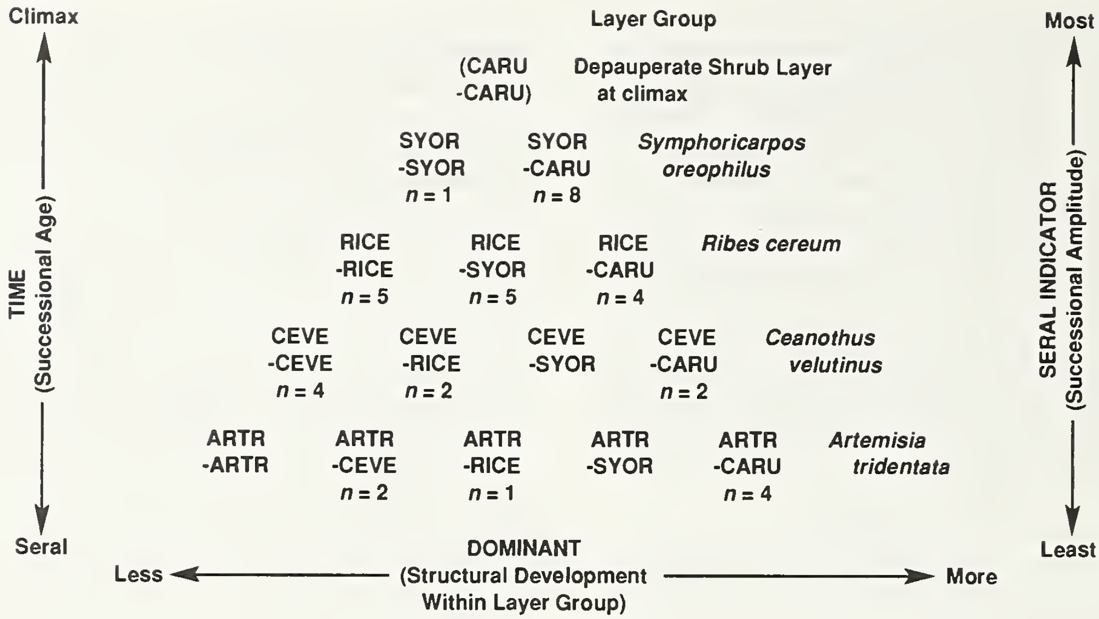

Figure 10—Succession classification diagram of the shrub layer in the PSME/CARU h.t., CARU phase (*n* = number of samples).

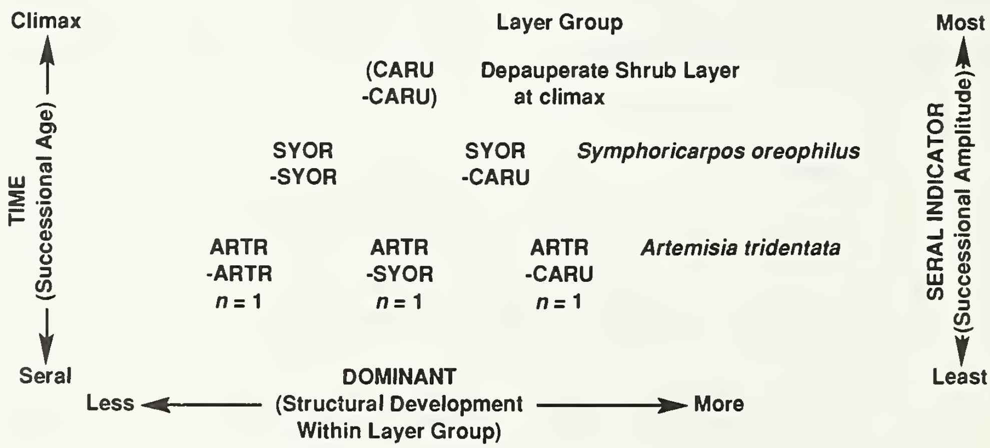

Figure 11—Succession classification diagram of the shrub layer in the PSME/CARU h.t., FEID phase (*n* = number of samples).

were not caused by the last disturbance but merely survived it. This is particularly true with low-intensity disturbances.

ARTEMISIA TRIDENTATA LAYER GROUP (ARTR L.G.)

Artemisia tridentata, mainly ssp. *vaseyana*, is an early seral colonizer of severely disturbed sites in the PSME/CARU h.t. It can be important in the CARU and FEID phases, but is usually a minor species in the PIPO phase. Both *Artemisia* and the alternate indicator *Chrysothamnus* (mainly *C. nauseosus*) are wind-disseminated, nonrhizomatous shrubs with little tolerance for shade (fig. 12). Although these genera may have different successional roles in nonforest habitats, their differences as compared to forest shrubs are too slight to warrant distinction. In PSME/CARU, both species will quickly invade soil exposed by scarification or burning. The initial shrub cover helps ameliorate conditions on the site, enhancing establishment of forest species.

The ARTR l.g. is relatively short-lived, progressing to any of the other shrub layer groups in the CARU or FEID phases. It can also progress directly to a climax *Calamagrostis* layer. Development of either a taller shrub layer or a tree canopy will cause the ARTR l.g. to decline.

Table 5—Key to shrub layer groups and layer types, with code numbers, in the PSME/CARU h.t.

		Code No.
1. *Artemisia tridentata* (including *Chrysothamnus*) well represented[1]	ARTR LAYER GROUP	150
1a. *Artemisia* (incl. *Chrysothamnus*) the dominant shrub		
1aa. *Artemisia* (incl. *Chrysothamnus*) coverage greater than *Calamagrostis*	ARTR-ARTR Layer Type	150.150
1ab. *Artemisia* (incl. *Chrysothamnus*) coverage less than or equal to *Calamagrostis*	ARTR-CARU Layer Type	150.307
1b. *Ceanothus* dominant or codominant with *Artemisia* (incl. *Chrysothamnus*)	ARTR-CEVE Layer Type	150.107
1c. *Ribes* spp. dominant or codominant with *Artemisia* (incl. *Chrysothamnus*)	ARTR-RICE Layer Type	150.128
1d. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Artemisia* (incl. *Chrysothamnus*)	ARTR-SYOR Layer Type	150.163
1. *Artemisia* (incl. *Chrysothamnus*) poorly represented	2	
2. *Purshia tridentata* well represented	PUTR LAYER GROUP	125
2a. *Purshia* the dominant shrub		
2aa. *Purshia* coverage greater than *Calamagrostis*	PUTR-PUTR Layer Type	125.125
2ab. *Purshia* coverage less than or equal to *Calamagrostis*	PUTR-CARU Layer Type	125.307
2b. *Ceanothus* dominant or codominant with *Purshia*	PUTR-CEVE Layer Type	125.107
2c. *Ribes* spp. dominant or codominant with *Purshia*	PUTR-RICE Layer Type	125.128
2d. *Salix* dominant or codominant with *Purshia*	PUTR-SASC Layer Type	125.137
2e. *Prunus* spp. dominant or codominant with *Purshia*	PUTR-PRVI Layer Type	125.124
2f. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Purshia*	PUTR-SYOR Layer Type	125.163
2. *Purshia* poorly represented	3	
3. *Ceanothus velutinus* well represented	CEVE LAYER GROUP	107
3a. *Ceanothus* the dominant shrub		
3aa. *Ceanothus* coverage greater than *Calamagrostis*	CEVE-CEVE Layer Type	107.107
3ab. *Ceanothus* coverage less than or equal to *Calamagrostis*	CEVE-CARU Layer Type	107.307
3b. *Ribes* spp. dominant or codominant with *Ceanothus*	CEVE-RICE Layer Type	107.128
3c. *Salix* dominant or codominant with *Ceanothus*	CEVE-SASC Layer Type	107.137
3d. *Prunus* spp. dominant or codominant with *Ceanothus*	CEVE-PRVI Layer Type	107.124
3e. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Ceanothus*	CEVE-SYOR Layer Type	107.163
3. *Ceanothus* poorly represented	4	
4. *Ribes* spp. (mainly *R. cereum*) well represented	RICE LAYER GROUP	128

(con.)

Table 5 (Con.)

		Code No.
4a. *Ribes* spp. the dominant shrub		
4aa. *Ribes* spp. coverage greater than *Calamagrostis*	RICE-RICE Layer Type	128.128
4ab. *Ribes* spp. coverage less than or equal to *Calamagrostis*	RICE-CARU Layer Type	128.307
4b. *Salix* dominant or codominant with *Ribes*	RICE-SASC Layer Type	128.137
4c. *Prunus* spp. dominant or codominant with *Ribes*	RICE-PRVI Layer Type	128.124
4d. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Ribes*	RICE-SYOR Layer Type	128.163
4. *Ribes* poorly represented	5	
5. *Salix scouleriana* well represented	SASC LAYER GROUP	137
5a. *Salix* the dominant shrub		
5aa. *Salix* coverage greater than *Calamagrostis*	SASC-SASC Layer Type	137.137
5ab. *Salix* coverage less than or equal to *Calamagrostis*	SASC-CARU Layer Type	137.307
5b. *Prunus* spp. dominant or codominant with *Salix*	SASC-PRVI Layer Type	137.124
5c. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Salix*	SASC-SYOR Layer Type	137.163
5. *Salix* poorly represented	6	
6. *Prunus virginiana* (incl. *P. emarginata*) well represented	PRVI LAYER GROUP	124
6a. *Prunus* spp. the dominant shrub		
6aa. *Prunus* coverage greater than *Calamagrostis*	PRVI-PRVI Layer Type	124.124
6ab. *Prunus* coverage less than or equal to *Calamagrostis*	PRVI-CARU Layer Type	124.307
6b. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Prunus*	PRVI-SYOR Layer Type	124.163
6. *Prunus* spp. poorly represented	7	
7. *Symphoricarpos oreophilus* (incl. *Amelanchier*) well represented	SYOR LAYER GROUP	163
7a. *Symphoricarpos* (incl. *Amelanchier*) coverage greater than *Calamagrostis*	SYOR-SYOR Layer Type	163.163
7b. *Symphoricarpos* (incl. *Amelanchier*) coverage less than or equal to *Calamagrostis*	SYOR-CARU Layer Type	163.307
7. *Symphoricarpos* (incl. *Amelanchier*) poorly represented	depauperate or unclassified shrub-layer	

[1]"Well represented" means canopy coverage ≥5 percent. "Dominant" refers to greatest canopy coverage regardless of height; "codominant" refers to nearly equal canopy coverage. When keying to layer type, choose the first condition that fits.

All five possible layer types in this layer group have been sampled (figs. 10, 11). The ARTR-CEVE layer type resulted from scarification and burning of heavy fuels, while the ARTR-RICE layer type resulted from heavy scarification with a light broadcast burn. The ARTR-SYOR and ARTR-CARU (fig. 13) layer types are mainly the result of lighter scarification. In some cases, this scarification was by livestock rather than machinery.

PURSHIA TRIDENTATA LAYER GROUP (PUTR L.G.)

Purshia tridentata is a nonrhizomatous shrub with considerable variability in growth habit

Figure 12—An ARTR-RICE shrub layer type in the Iron Creek drainage southwest of Salmon, ID, in 1983. A clearcut and low-intensity broadcast burn occurred here in 1962. The area also received thorough scarification and contour stripping. *Ribes cereum* and *R. viscosissimum* (both from buried seed) and *Chrysothamnus nauseosus* (alternate indicator of *Artemisia*) from wind-borne seed are well represented as a result of the scarification. *Ceanothus* is well represented due to the burning.

Figure 13—An ARTR-CARU shrub layer type in the Iron Creek drainage southwest of Salmon, ID, in 1983. This site was clearcut in 1962. The logging slash was bulldozer-piled and burned. *Artemisia* established from wind-borne seed in response to the mechanical scarification and full sunlight. The *Calamagrostis* survived the scarification and increased from rhizomes and possibly seed.

between populations. Some populations, particularly those at upper elevations, are more prostrate and have a greater tendency to increase by layering (Nord 1965). Blaisdell and Mueggler (1956) reported that some *Purshia* stands in eastern Idaho resprout after burning. In central Idaho forests, some *Purshia* stands resprout following spring burns, but are killed by the more intense fall burns. *Purshia* is a successful colonizer, pioneering on many harsh sites having coarse-textured soils. It has some potential to fix nitrogen (Dalton and Zobel 1977). Colonization may be slow initially, but can increase as a seed source becomes established. Small rodents are responsible for most dissemination of the relatively heavy, smooth seed (Nord 1965). Thus, long-range dispersal is rare. In the PSME/CARU h.t. most *Purshia* seedlings appear in small clusters, as if sprouting from a seed cache. Although many seeds also fall near the parent plant, seedlings rarely establish there. This phenomenon has been attributed to a toxin in the *Purshia* litter that apparently inhibits seedling development (Nord 1965; Nord and Van Atta 1960).

Four of the seven *Purshia* layer types were encountered (fig. 9). In most cases, the layer type resulted from scarification associated with partial cutting of the ponderosa pine overstory (fig. 14). None was associated with burning. All of these shrub layers had intermittent canopies and should not outcompete ponderosa pine seedlings.

CEANOTHUS VELUTINUS LAYER GROUP (CEVE L.G.)

Ceanothus velutinus is a shade-intolerant, nonrhizomatous shrub that is valuable for big-game browse, songbird habitat, and nitrogen fixation. It can store viable seed in the soil and duff for at least 200 to 300 years that germinates readily following burning (Reed 1974). In PSME/CARU, *Ceanothus* attains heights of 2 to 4 ft (0.6 to 1.2 m). In more productive habitat types such as grand fir/mountain maple, *Ceanothus* grows to about 7 ft (2.1 m) (Steele and Geier-Hayes 1992). *Ceanothus* is approaching its environmental limits in PSME/CARU. As elevations increase, *Ceanothus* becomes stunted, possibly from repeated frost damage or inadequate snow cover during winter. *Ceanothus* reaches its cold limits in the CARU phase. It was not found in the drier FEID phase, which has even less snow cover.

In PSME/CARU, the CEVE layer group is widespread in the PIPO phase. It also occurs in lower elevations of the CARU phase but is often less developed. Most of the *Ceanothus* succession described by Lyon (1971) in central Idaho occurred in lower

Figure 14—A PUTR-PUTR shrub layer type southeast of Placerville, ID, in 1986. The area experienced a partial cut and mechanical scarification 6 years ago. *Purshia* has increased considerably in response to the scarification and increased sunlight. Now it forms a dominant shrub layer on the site.

Figure 15—A CEVE-CEVE shrub layer type northwest of Carmen, ID, in 1983. A clearcut and high-intensity broadcast burn occurred here in 1964. *Pseudotsuga* was planted the following spring. The survivors are now well above the shrub layer. *Ceanothus velutinus* germinated from buried seed in response to the burn. It now forms a dense shrub layer, which protects the site from heavy cattle use in this area.

elevations of the CARU phase; the remainder occurred in the Douglas-fir/mountain maple habitat type.

Of the six CEVE layer types that may occur in PSME/CARU, five were found in the PIPO phase (fig. 9) and three were found in the CARU phase (fig. 10). Typically, they reflect responses to various intensities or frequencies of burning, but they may also appear following scarification. CEVE layer types are perhaps the easiest shrub layer to achieve following disturbance. They respond dependably to burning on slopes with good cold air drainage. They are not apt to appear in areas that accumulate cold air. In general, CEVE layer types reach peak development on deforested sites that have been burned (fig. 15). They are also common beneath pole-size stands (usually declining) and can persist in open stands of fire-maintained, old ponderosa pine.

With proper site treatment, CEVE layer types can be a protective cover for disturbed sites. A dense canopy of *Ceanothus* (from high-intensity burns) will deter livestock and erosion; a light canopy (from low-intensity burns) can provide shelter for *Pseudotsuga* seedlings. Following clearcutting and burning in the Cascade Range, *Ceanothus* enhanced stockability and growth of *Pseudotsuga* seedlings for about the first 7 years, after which competition began to outweigh the benefits (Youngberg and others 1979). The improved performance of *Pseudotsuga* was attributed to higher nitrogen levels, amelioration of microenvironment, or a combination of the two.

RIBES CEREUM LAYER GROUP (RICE L.G.)

The RICE layer group is denoted mainly by *Ribes cereum*, but occasionally *R. viscosissimum* and small amounts of other *Ribes* species may be present. *Ribes* are characteristically early seral nonrhizomatous shrubs, often the first to dominate well-scarified sites. They begin declining shortly after a canopy taller than their own develops, since they have a low tolerance for shade. *Ribes* seem to maintain their coverages longer than *Ceanothus,* so are considered slightly less vulnerable to succession. Like *Ceanothus*, numerous *Ribes* seeds remain viable in the soil and duff long after the parent shrubs have disappeared.

The RICE layer group occurs in all three phases of PSME/CARU, but is most common in the CARU phase. Here it occurs following broadcast burning as well as scarification and is even more common than the CEVE layer group. Many sites in PSME/CARU have low fuel loadings after timber harvest,

leading to low-intensity, often patchy, broadcast burns. Consequently, more *Ribes* germinates afterward than does *Ceanothus*. Also, the *Ceanothus* is generally near its environmental limits, so it is poorly represented or absent after burning. Secondly, many sites in PSME/CARU occur in frost pockets where a CEVE layer group will not develop even after high-intensity burns. The *Ribes*, however, is less affected by frost. In such areas, it can develop a sparse RICE layer group after scarification from logging.

Of the five potential layer types in the RICE layer group, three were found (figs. 9, 10). In the PIPO phase, RICE layer types resulted mainly from clearcutting and scarification without burning. In the CARU phase, RICE layer types occurred following scarification as well as broadcast burning. Although machines scarified most sites that developed RICE layer types, livestock appear to have further scarified a few sites.

RICE layer types can develop quickly following disturbance, but seldom create dense canopies (fig. 16). Planted pines may be overtopped by young *Ribes* for several years following planting, but the sparse *Ribes* canopy seldom outcompetes the pine. As *Ribes* plants get older, their canopies thicken somewhat, providing favorable microsites for *Pseudotsuga* seedlings. The *Pseudotsuga*, in turn, will shade out the *Ribes* more readily than a pine canopy because it creates denser shade.

SALIX SCOULERIANA LAYER GROUP (SASC L.G.)

Salix scouleriana is a nonrhizomatous shrub with high value as big-game browse (appendix A). It can also provide habitat for small birds to nest and feed and site protection for conifer seedlings. Though *Salix* is only slightly tolerant of shade, its tall growth habit (up to 14 ft [4¼ m] in PSME/CARU) and sprouting ability enable this *Salix* to persist in small openings on well-timbered sites. Its light, windblown seeds are dispersed in late spring, require moist mineral soil for germination, and are viable for just a short time (Brinkman 1974).

The SASC l.g. occurs mainly in the PIPO phase even though some *Salix* may occur in the CARU phase. This layer group represents a midseral stage of shrub layer succession. In addition to *Salix*, *Prunus*, *Amelanchier,* and *Symphoricarpos* may be well represented.

The SASC l.g. contains four layer types (fig. 9), two of which were sampled. Of the remaining types, SASC-PRVI is apt to be rare since the data (appendix A) suggest that high coverages of *Salix* and

Figure 16—A RICE-RICE shrub layer type in the Noho Creek drainage north of Stanley, ID, in 1989. This area was essentially clearcut 16 years ago and then thoroughly scarified when the logging slash was bulldozer-piled. *Ribes cereum* germinated from buried seed in response to the scarification. It now dominates a sparse shrub layer.

Prunus virginiana are mutually exclusive in PSME/CARU. The other type, SASC-SYOR, probably will be found since a few sampled stands now in CEVE-CEVE contain both *Salix* and *Symphoricarpos*. They could progress to SASC-SYOR as the *Ceanothus* declines.

Under natural conditions, the SASC layer group results from wildfire. Many broadcast burns are not hot enough to create an adequate seedbed for *Salix*. Such treatments usually generate a CEVE layer type without *Salix,* bypassing the SASC l.g. during succession. SASC layer types have been created in clearcuts where exposed soil was mounded to trap water behind the mounds, creating well-watered spots of mineral soil. Most stands sampled in this layer group had been clearcut about 20 years ago; all had received heavy machine scarification from pile and burn or contour terrace operations.

PRUNUS VIRGINIANA LAYER GROUP (PRVI L.G.)

Prunus virginiana and the alternate indicator, *P. emarginata,* are semi-shade-tolerant shrubs. They generate many root sprouts and tend to form thickets that provide important food and cover for songbirds, small mammals, deer, elk, and bear. Birds and mammals disperse the heavy, flesh-covered seeds in the fall. These seeds can remain viable in the soil and duff for many years (Kramer 1984). The seed has an embryo dormancy and requires an afterripening period (Grisez 1974) that is offset by winter conditions. It germinates in early spring and probably responds best to broadcast burning. *Prunus emarginata* is less widespread in PSME/CARU than is *P. virginiana* and appears to be slightly less shade tolerant.

In central Idaho the PRVI l.g. occurs only in the PIPO phase of PSME/CARU; the CARU and FEID phases are apparently too cold for *Prunus*. In eastern Idaho the PRVI l.g. occurs in the PAMY phase (Steele and others 1983) and, to some extent, in the CARU phase. The PRVI l.g. contains three layer types (fig. 9), all of which have been sampled (appendix A). Usually these areas had little or no severe disturbance after being severely burned 50 to 100 years ago. Apparently, the *Ceanothus* that would have germinated after the fire has been reduced by shrub layer succession, or little *Ceanothus* seed was stored in the soil at the time of the last fire. More recent disturbances have been mainly from grazing or logging without site preparation, neither of which appears to greatly alter these shrub layers.

Deep and thorough scarification is needed to remove PRVI communities, in which case a CEVE or RICE shrub layer type will likely develop. It may also be possible to replace PRVI layer types with CEVE layer types through severe burning if sufficient fuels exist. In this case, a CEVE-PRVI layer type is most apt to occur. In most cases, once a *Prunus* layer has established, it will persist until it is replaced successionally or killed by herbicides.

SYMPHORICARPOS OREOPHILUS LAYER GROUP (SYOR L.G.)

Symphoricarpos oreophilus is a nonrhizomatous, moderately shade-tolerant shrub widespread in central Idaho. It produces a fruit that, though not eagerly sought, is probably dispersed by birds and mammals. *Symphoricarpos* seedlings are usually found in a dense cluster, as if they began growing from a cache made by a small rodent. This shrub has low-to-moderate forage value for large herbivores (appendix A). It is often well represented on timbered sites, as well as deforested areas.

Amelanchier alnifolia is considered an alternate indicator of the SYOR layer group. In PSME/CARU it is less widespread than *Symphoricarpos*, occurring mainly in the PIPO phase. It is a common nonrhizomatous shrub that occurs in many shrub layer types. It produces a fleshy fruit that is usually dispersed by birds and mammals and has moderate-to-high forage value for deer, elk, and black bear (appendix A). *Amelanchier,* which has intermediate shade tolerance, is often well represented on timbered sites as well as on open brushfields. Because it has more shade tolerance than most other shrubs in PSME/CARU, its coverage declines more slowly as the tree canopy increases, making it an indicator of late seral conditions.

The SYOR l.g. is common in both the PIPO and CARU phases. Though not climax, it represents the culmination of shrub layer succession in PSME/CARU. With increasing tree canopy density, the SYOR l.g. gradually declines, becoming an insignificant element of the *Calamagrostis*-dominated undergrowth. At the dry extreme of PSME/CARU and on rocky sites, potential tree density may be less. There, the SYOR l.g. may persist indefinitely.

The Herb Layer

Herb layer succession is generally more complex than tree or shrub layer succession because more herbaceous species can occupy the site. Since herb layer succession can be truncated by the tree and shrub layers, however, many herb layer types are rarely found. One might assume that herb layer succession in PSME/CARU, which is relatively dry, would be less complex than in more moderate habitats. This does not appear to be the case. Species from even drier habitats become seral components in PSME/CARU, maintaining a diversity comparable to that of moister forest habitats.

Table 6 lists the important herb layer species, those with greater than 5 percent cover. Many

Table 6—Successional roles of important herb layer species in phases of the PSME/CARU h.t.

Code No.	Herb layer species	Abbreviation	Phase PIPO	Phase CARU
	Perennial graminoids			
303	*Bromus carinatus*	BRCA	ES[1]	ES
282	*Bromus inermis*	BRIN	ES	—
307	*Calamagrostis rubescens*	CARU	C	C
309	*Carex geyeri*	CAGE	LS	LS
311	*Carex rossii*	CARO	ES	ES
331	*Poa nervosa*	PONE	LS	LS
	Perennial herbs			
414	*Antennaria microphylla*	ANMI	ms	MS
413	*Antennaria racemosa*	ANRA	c	(C)
415	*Apocynum androsaemifolium*	APAN	MS	—
421	*Arnica cordifolia*	ARCO	C	C
426	*Aster conspicuus*	ASCO	LS	—
459	*Epilobium angustifolium*	EPAN	MS	MS
465	*Fragaria vesca*	FRVE	MS	MS
466	*Fragaria virginiana*	FRVI	MS	MS
473	*Geranium viscosissimum*	GEVI	MS	MS
833	*Iliamna rivularis*	ILRI	(ES)	es
641	*Lupinus argenteus*	LUAR	—	(LS)
728	*Lupinus caudatus*	LUCA	(LS)	LS
643	*Lupinus sericeus*	LUSE	(LS)	LS
658	*Penstemon attenuatus*	PEAT	(MS)	(MS)
522	*Potentilla glandulosa*	POGL	ES	ES
691	*Veratrum californicum*	VECA	MS	—

[1]ES = early seral; MS = midseral; LS = late seral; C = climax; upper case letters = major cover species; lower case letters = minor cover species; ( ) = occurs in only part of phase.

unlisted species may be present in lesser amounts. Some potentially important species may yet be found. Relative successional amplitudes of important herb layer species (fig. 17) were derived by developing hypotheses for each species followed by field testing and data analysis. Because succession in the herb layer progresses more rapidly than succession in the tree or shrub layer, successional amplitudes for some herb layer species were derived from the permanent plot records of Stickney (1980, 1985). As in the tree and shrub layers, successional amplitudes of herb layer species are meaningful only in a relative sense. Amplitudes that are the farthest apart are the most likely to be accurate. For instance, species indicating the Annuals layer group clearly have less amplitude than *Calamagrostis* (fig. 17). But the relative amplitudes of adjacent taxa such as *Fragaria* and *Apocynum* are less certain.

The relative successional amplitudes in figure 17 provide a basis for the herb layer classifications (figs. 18, 19). These classifications each consist of ten layer groups; the full data set appears in appendix C. Although the herb layer classification is based on 86 sample plots in the CARU phase and 65 in the PIPO phase, some layer groups have little data. Data in the Annuals layer group are scarce, because these conditions often occur within 5 years after disturbance. Recently disturbed sites were not a sampling objective. Other layer types may be found with more reconnaissance, may appear only after uncommon disturbances, or may be rare under any circumstances.

A key to herb layer types (table 7) is easily derived from the classification diagrams (figs. 18, 19). This key contains numerous alternate indicator species. Species must be lumped together to maintain a workable number of units in this diverse vegetative layer. Unfortunately, in some cases, combining indicator species has reduced uniformity within the unit. The combined species represent minor differences of environment or disturbance response within the habitat type. In other cases, the alternate indicators represent similar environments and response to disturbance, and the classified unit retains substantial uniformity. In all cases, the lumped species appear to have similar successional amplitudes (fig. 17).

Early seral annuals, biennials, and short-lived perennials were grouped into one unit, because there appears to be no practical reason to recognize them individually. *Carex rossii* was grouped with *Potentilla* because it responds similarly to scarification.

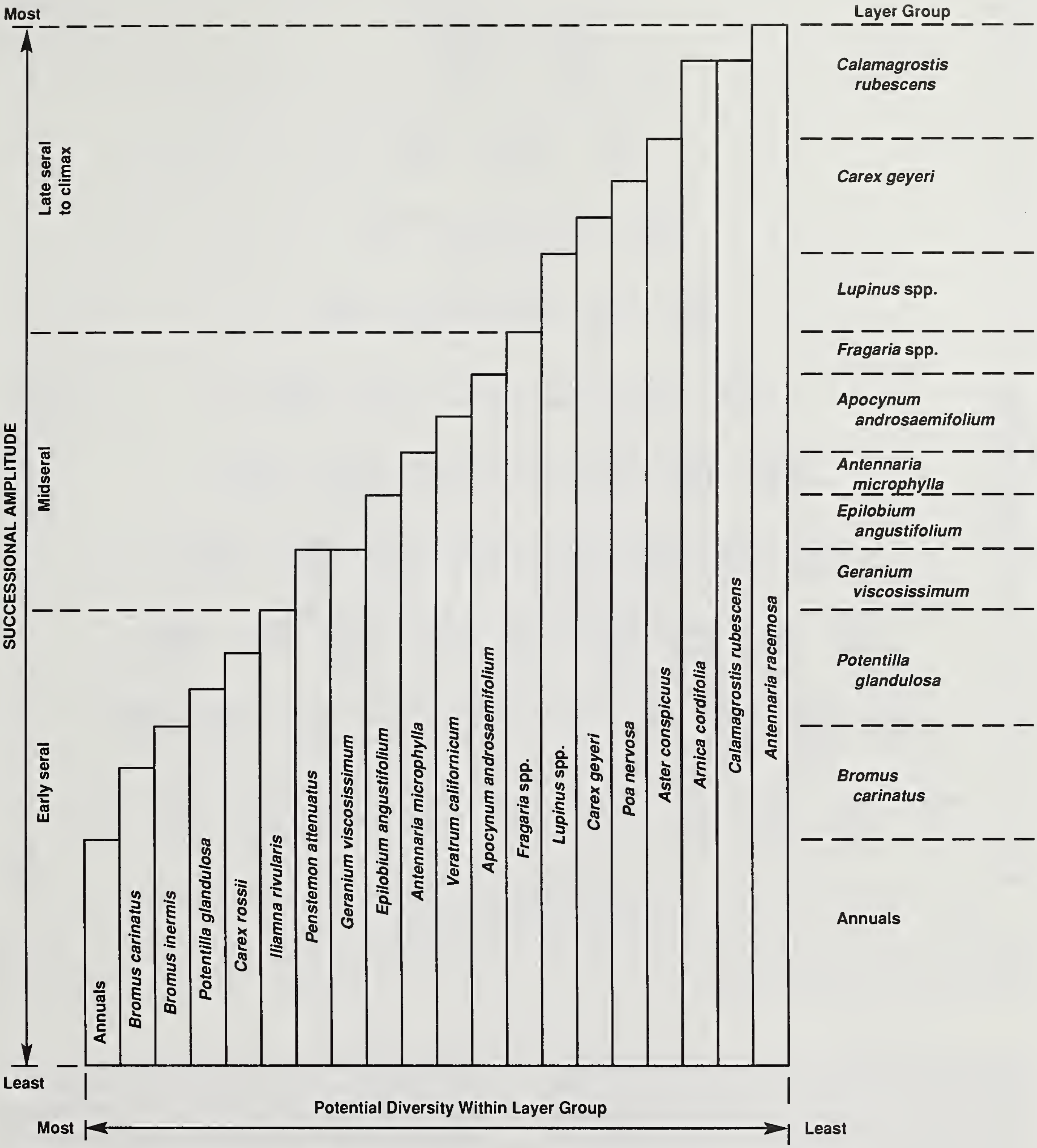

Figure 17—Relative successional amplitudes of important herb layer species in the PSME/CARU h.t.

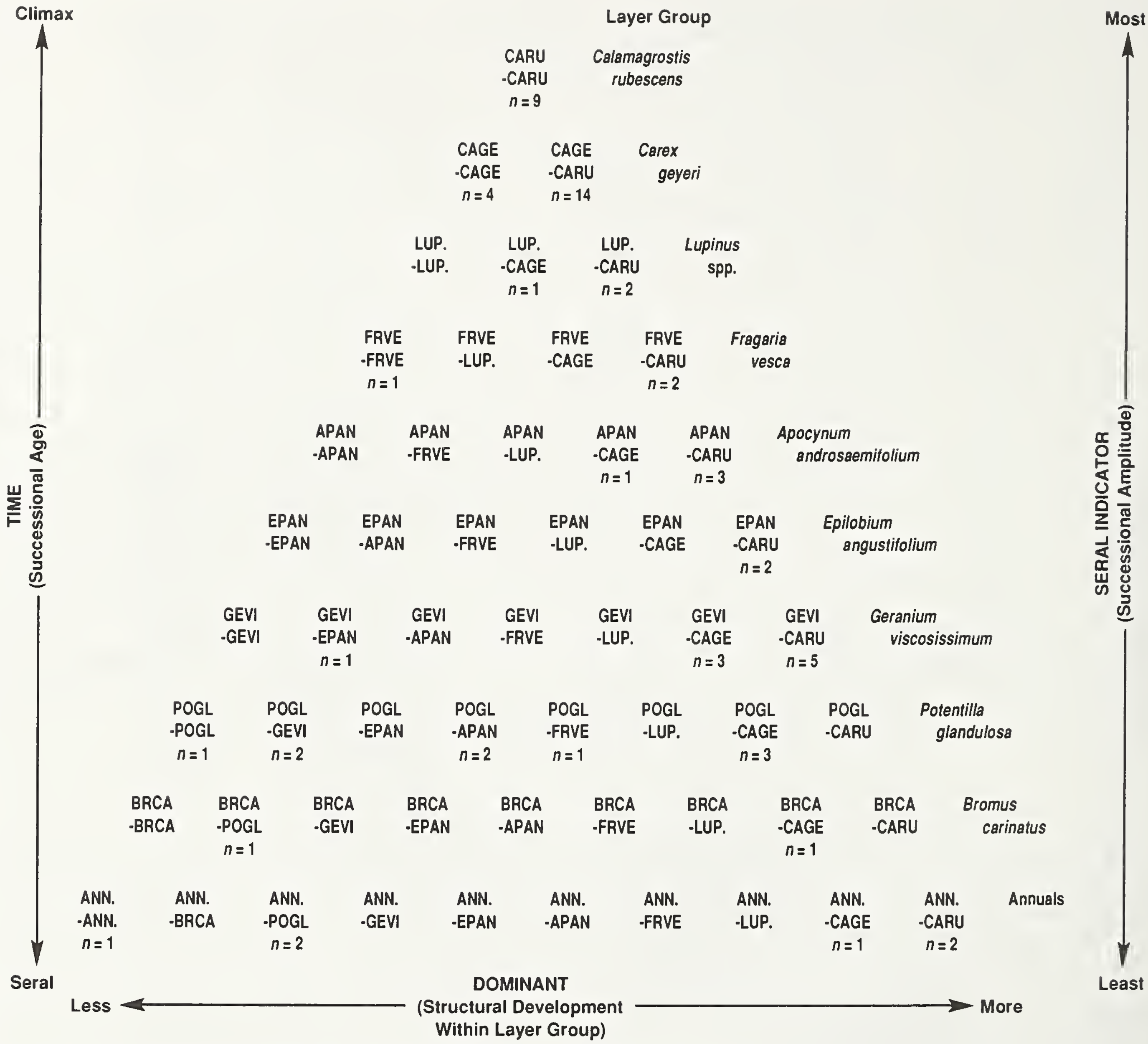

Figure 18—Succession classification diagram of the herb layer in the PSME/CARU h.t., PIPO phase (*n* = number of samples).

Iliamna was grouped with *Potentilla* because both have seed stored in the soil. *Veratrum* was grouped with *Apocynum* since both are midseral rhizomatous species with low palatability to livestock. *Poa nervosa* and *Aster conspicuus* were grouped with *Carex geyeri* as common, late seral associates. *Arnica cordifolia* and *Antennaria racemosa* were grouped with *Calamagrostis* as climax indicators.

ANNUALS LAYER GROUP (ANN. L.G.)

Annuals, mainly species of *Collinsia*, *Collomia*, *Epilobium*, and *Gayophytum,* can develop high coverages on newly exposed soil. These taxa have little competitive ability. Their annual nature makes them vulnerable to replacement by any perennial. Likewise, biennials such as *Verbascum* and *Cirsium vulgare* and the short-lived perennials *Phacelia* and *Gnaphalium* must reestablish frequently in order to maintain high coverages. Without recurring disturbance, these taxa are also easily replaced. The relative amounts of these early seral colonizers vary considerably following disturbance, apparently as a function of seed availablity rather than the type of disturbance.

The Annuals layer group represents the earliest seral conditions of the herb layer. It is often replaced

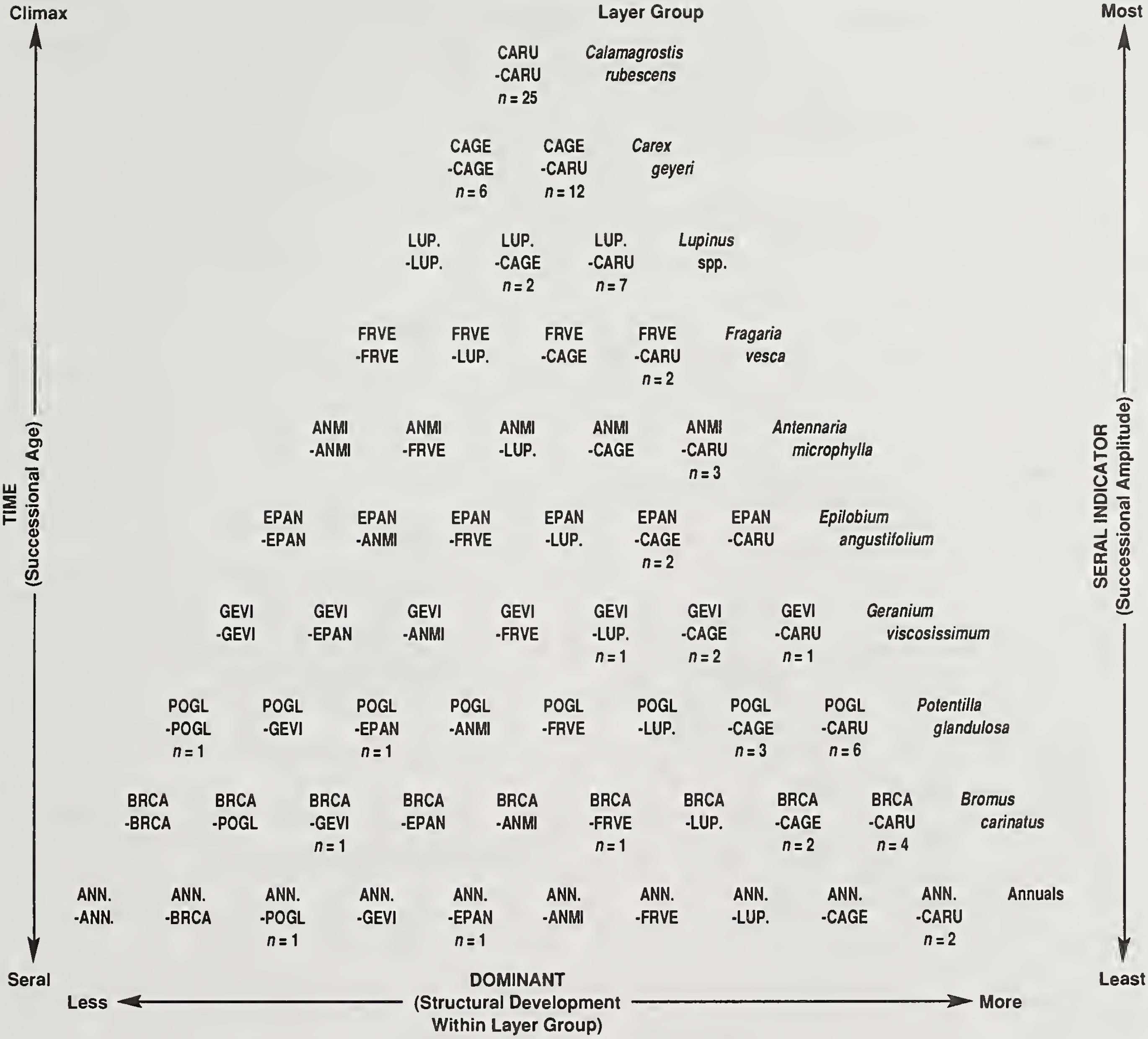

Figure 19—Succession classification diagram of the herb layer in the PSME/CARU h.t., CARU phase (n = number of samples).

within the first 5 years following disturbance. A few Annuals layer types were encountered, although they were not a sampling objective (figs. 18, 19). Some areas with Annuals layer types had been logged as much as 18 years ago. Heavy livestock use may have maintained these layer types. Most Annuals layer types resulted from clearcutting or partial cutting followed by dozer scarification. A few sites had experienced a recent wildfire. Pocket gophers were found on several of the sites.

BROMUS CARINATUS LAYER GROUP (BRCA L.G.)

Bromus carinatus is a nonrhizomatous grass with little shade tolerance. It decreases under grazing, mainly from cattle. Occasionally, it develops high coverages in early seral stages, either from direct seeding or natural colonization. In such cases, the sites receive little or no grazing. *Bromus inermis* is a rhizomatous grass that usually results from direct seeding. It can develop high coverages on ungrazed

Table 7—Key to herb layer groups and layer types, with code numbers, in the PSME/CARU h.t.

		Code No.
1. Annuals, biennials, and short-lived perennials (see layer group description for species) well represented[1] either individually or collectively	ANNUALS LAYER GROUP	900
1a. The above species dominant	ANN.-ANN. Layer Type	900.900
1b. *Bromus carinatus* (incl. *Bromus inermis*) dominant or codominant	ANN.-BRCA Layer Type	900.303
1c. *Potentilla glandulosa* (incl. *Carex rossii* and *Iliamna rivularis*) dominant or codominant	ANN.-POGL Layer Type	900.522
1d. *Geranium viscosissimum* (incl. *Penstemon attenuatus*) dominant or codominant	ANN.-GEVI Layer Type	900.473
1e. *Epilobium angustifolium* dominant or codominant	ANN.-EPAN Layer Type	900.459
1f. *Antennaria microphylla* dominant or codominant	ANN.-ANMI Layer Type	900.414
1g. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	ANN.-APAN Layer Type	900.415
1h. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	ANN.-FRVE Layer Type	900.465
1i. *Lupinus* spp. dominant or codominant	ANN.-LUP. Layer Type	900.499
1j. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	ANN.-CAGE Layer Type	900.309
1k. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	ANN.-CARU Layer Type	900.307
1. Annuals, biennials, and short-lived perennials poorly represented	2	
2. *Bromus carinatus* (incl. *B. inermis*) well represented	BRCA LAYER GROUP	303
2a. The above species dominant	BRCA-BRCA Layer Type	303.303
2b. *Potentilla glandulosa* (incl. *Carex rossii* and *Iliamna rivularis*) dominant or codominant	BRCA-POGL Layer Type	303.522
2c. *Geranium viscosissimum* (incl. *Penstemon attenuatus*) dominant or codominant	BRCA-GEVI Layer Type	303.473
2d. *Epilobium angustifolium* dominant or codominant	BRCA-EPAN Layer Type	303.459
2e. *Antennaria microphylla* dominant or codominant	BRCA-ANMI Layer Type	303.414
2f. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	BRCA-APAN Layer Type	303.415
2g. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	BRCA-FRVE Layer Type	303.465
2h. *Lupinus* spp. dominant or codominant	BRCA-LUP. Layer Type	303.499
2i. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus)* dominant or codominant	BRCA-CAGE Layer Type	303.309
2j. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	BRCA-CARU Layer Type	303.307
2. *Bromus carinatus* (incl. *B. inermis*) poorly represented.	3	

(con.)

Table 7 (Con.)

		Code No.
3. *Potentilla glandulosa* (incl. *Carex rossii* and *Iliamna rivularis*) well represented	POGL LAYER GROUP	522
3a. The above species dominant	POGL-POGL Layer Type	522.522
3b. *Geranium viscosissimum* (incl. *Penstemon attenuatus*) dominant or codominant	POGL-GEVI Layer Type	522.473
3c. *Epilobium angustifolium* dominant or codominant	POGL-EPAN Layer Type	522.459
3d. *Antennaria microphylla* dominant or codominant	POGL-ANMI Layer Type	522.414
3e. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	POGL-APAN Layer Type	522.415
3f. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	POGL-FRVE Layer Type	522.465
3e. *Lupinus* spp. dominant or codominant	POGL-LUP. Layer Type	522.499
3g. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	POGL-CAGE Layer Type	522.309
3h. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	POGL-CARU Layer Type	522.307
3. *Potentilla glandulosa* (incl. *Carex rossii* and *Iliamna rivularis*) poorly represented	4	
4. *Geranium viscosissimum* (incl. *Penstemon attenuatus*) well represented	GEVI LAYER GROUP	473
4a. The above species dominant	GEVI-GEVI Layer Type	473.473
4b. *Epilobium angustifolium* dominant or codominant	GEVI-EPAN Layer Type	473.459
4c. *Antennaria microphylla* dominant or codominant	GEVI-ANMI Layer Type	473.414
4d. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	GEVI-APAN Layer Type	473.415
4e. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	GEVI-FRVE Layer Type	473.465
4f. *Lupinus* spp. dominant or codominant	GEVI-LUP. Layer Type	473.499
4g. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	GEVI-CAGE Layer Type	473.309
4h. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	GEVI-CARU Layer Type	473.307
4. *Geranium viscosissimum* (incl. *Penstemon attenuatus*) poorly represented	5	
5. *Epilobium angustifolium* well represented	EPAN LAYER GROUP	459
5a. The above species dominant	EPAN-EPAN Layer Type	459.459
5b. *Antennaria microphylla* dominant or codominant	EPAN-ANMI Layer Type	459.414
5c. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	EPAN-APAN Layer Type	459.415
5d. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	EPAN-FRVE Layer Type	459.465

(con.)

		Code No.
5e. *Lupinus* spp. dominant or codominant	EPAN-LUP. Layer Type	459.499
5f. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	EPAN-CAGE Layer Type	459.309
5g. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	EPAN-CARU Layer Type	459.307
5. *Epilobium angustifolium* poorly represented	6	
6. *Antennaria microphylla* well represented.	ANMI LAYER GROUP	414
6a. The above species dominant	ANMI-ANMI Layer Type	414.414
6b. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	ANMI-APAN Layer Type	414.415
6c. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	ANMI-FRVE Layer Type	414.465
6d. *Lupinus* spp. dominant or codominant	ANMI-LUP. Layer Type	414.499
6e. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	ANMI-CAGE Layer Type	414.309
6f. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	ANMI-CARU Layer Type	414.307
6. *Antennaria microphylla* poorly represented	7	
7. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) well represented	APAN LAYER GROUP	415
7a. The above species dominant	APAN-APAN Layer Type	415.415
7b. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	APAN-FRVE Layer Type	415.465
7c. *Lupinus* spp. dominant or codominant	APAN-LUP. Layer Type	415.499
7d. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	APAN-CAGE Layer Type	415.309
7e. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	APAN-CARU Layer Type	415.307
7. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) poorly represented	8	
8. *Fragaria vesca* (incl. *F. virginiana*) well represented	FRVE LAYER GROUP	465
8a. The above species dominant	FRVE-FRVE Layer Type	465.465
8b. *Lupinus* spp. dominant or codominant	FRVE-LUP. Layer Type	465.499
8c. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	FRVE-CAGE Layer Type	465.309
8d. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	FRVE-CARU Layer Type	465.307
8. *Fragaria vesca* (incl. *F. virginiana*) poorly represented	9	
9. *Lupinus* spp. well represented	LUP. LAYER GROUP	499
9a. The above species dominant	LUP.-LUP. Layer Type	499.499
9b. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	LUP.-CAGE Layer Type	499.309

(con.)

Table 7 (Con.)

		Code No.
9c. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	LUP.-CARU Layer Type	499.307
9. *Lupinus* spp. poorly represented	10	
10. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) well represented	CAGE LAYER GROUP	309
10a. The above species dominant	CAGE-CAGE Layer Type	309.309
10b. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	CAGE-CARU Layer Type	309.307
10. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) poorly represented	11	
11. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) well represented	CARU LAYER GROUP	307
11a. The above species dominant	CARU-CARU Layer Type	307.307
11. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) poorly represented	depauperate or unclassified layer type	

[1]"Well represented" means canopy coverage ≥ 5 percent. "Dominant" refers to greatest canopy coverage regardless of height; "codominant" refers to nearly equal canopy coverage. When keying to layer type, choose first condition that fits.

sites, but was rarely found in the PSME/CARU h.t., CARU phase. On the PIPO phase, *B. inermis* occurs more frequently. Through its rhizomatous habit of spreading, it may dominate the herb layer so extensively that natural tree seedlings rarely establish. Planted tree seedlings may show poor survival and growth. As with most grasses, these bromes store little or no seed in the soil (Kramer 1984; Strickler and Edgerton 1976). The seed is often applied to recently disturbed areas as part of a mixture. But if substantial coverages of *Calamagrostis rubescens* exist before disturbance, it should not be necessary to seed grasses to stabilize soil (Crane, Habeck, and Fischer 1983).

BRCA layer types were scarce in the PIPO phase of PSME/CARU but were fairly common in the CARU phase (figs. 18, 19). They occurred mostly in areas that experienced a clearcut or seedtree cut 12 to 22 years ago. One BRCA layer type resulted from direct seeding following a wildfire 9 years ago. Burning and scarification were equally likely to produce BRCA layer types. Little or no grazing was evident on most sites.

POTENTILLA GLANDULOSA LAYER GROUP (POGL L.G.)

The perennial forb, *Potentilla glandulosa*, is nonrhizomatous and intolerant of shade. It flowers readily in full sunlight, producing large numbers of seeds, which are stored in the soil (Kramer 1984). The seeds often germinate profusely following scarification of the site by machinery or heavy livestock use. *Potentilla* seems to be less palatable to livestock than most associated herbs. Grazing can reduce more palatable species to the point that *Potentilla* is the only remaining species well represented on the site.

Carex rossii is a nonrhizomatous sedge that stores its seed in the soil or duff (Kramer 1984). The seed germinates readily following scarification but responds poorly to burning. On thoroughly scarified sites, *C. rossii* can dominate the herb layer and remain well represented until replaced by taller species. In spring, it provides some forage for large herbivores. In PSME/CARU, *C. rossii* often associates with *Potentilla*. It is more abundant in the cooler CARU phase than in the PIPO phase. This *Carex* appears to be a successional equivalent of *Potentilla*.

Iliamna rivularis is a nonrhizomatous, early seral perennial. It can flower profusely in full sun producing seed that stores in the soil for long periods (Kramer 1984). This species can become well represented following clearcutting and intense broadcast burning, or where slash has been piled and burned. It may also appear following high-intensity wildfire. High coverages of *Iliamna* are common in other

habitat types such as Douglas-fir/mountain maple and Douglas-fir/elk sedge but are rare in PSME/CARU.

POGL layer types are common in PSME/CARU, resulting mainly from scarification without burning 4 to 24 years ago (fig. 20). On a few sites, heavy livestock use appears to have maintained the POGL layer type. Bulldozer-piling operations are the most common cause of POGL layer types, but extensive skidding can produce similar vegetation. Pocket gophers are often prevalent in these herb layers, particularly in the PIPO phase. Other wildlife values appear low. These POGL layer types may persist until a tree or shrub layer begins to shade the site. In full sun, they may progress to a GEVI layer type. In either case, the more advanced layer type generally has less appeal to pocket gophers.

GERANIUM VISCOSISSIMUM LAYER GROUP (GEVI L.G.)

Geranium viscosissimum is a nonrhizomatous forb that has some tolerance for light shade. It apparently increases wherever grazing, especially by sheep, has been reduced. It is often a significant component of ungrazed forb communities in mid-seral condition. Apparently, *G. viscosissimum* has limited ability to store its seed in the soil and duff (Kramer 1984).

Penstemon attenuatus is a forb with a woody base that forms small mats. It can tolerate partial shade but requires bare soil for establishment. We do not know if *P. attenuatus* seed will store in the soil, but other species such as *P. wilcoxii* (Kramer 1984) have some ability to store seed. It is likely that *P. attenuatus* does too.

GEVI layer types were found in both the PIPO and CARU phases of PSME/CARU. They generally result either from low-intensity disturbances or the succession from BRCA and POGL layer types (themselves resulting from severe disturbances). Grazing pressure is usually light to nil.

EPILOBIUM ANGUSTIFOLIUM LAYER GROUP (EPAN L.G.)

Epilobium angustifolium is a rhizomatous perennial that can establish readily from wind-transported seed. In open areas created by stand-destroying wildfire it characteristically colonizes bare soil, forming extensive colonies that bloom profusely (Stickney 1985). These colonies can develop either from seed or from rhizomes that survive the fire. *Epilobium*, however, does not always need burned

Figure 20—A POGL-POGL herb layer type on Banner Ridge southeast of Lowman, ID, in 1986. The site was clearcut in 1974 and well scarified with a bulldozer. *Potentilla glandulosa* germinated profusely from seed buried in the soil and now dominates the herb layer.

areas for establishment. In clearcuts it often appears on burned or unburned bulldozer-piled debris, where soil and debris have been mixed. Apparently, the required substrate for *Epilobium* is deep, loose soil, usually exposed by either fire or logging. Besides providing color to the landscape, *Epilobium* is highly palatable to deer, elk, and sheep and is a major nectar source for hummingbirds. It is most productive in full sun but can persist in a depauperate condition beneath partial shade.

EPAN layer types are not widespread in PSME/CARU but are found in moister portions of both the PIPO and CARU phases. These layer types usually reflect disturbances created by wildfire or broadcast burning (fig. 21). EPAN layer types that established from past wildfire and are now depauperate may be rejuvenated by clearcutting or partial cutting without burning. These layer types may occur in large openings but are also found beneath a partial tree canopy. Shrubs, especially *Ceanothus*, frequently dominate these herb layers.

ANTENNARIA MICROPHYLLA LAYER GROUP (ANMI L.G.)

Antennaria microphylla is a mat-forming perennial that can establish from wind-transported seed. It generally colonizes bare, scarified soil and can persist beneath a partial tree canopy. Although this *Antennaria* occurs throughout the PSME/CARU h.t., it attains its highest coverages near the cool, dry extremes where the herb layer is more depauperate.

ANMI layer types were found only in the CARU and FEID phases of PSME/CARU. They resulted mainly from scarification without burning. Light to moderate grazing was evident on most sites. These layer types appear to persist on the site and progress slowly to either the LUP. or CARU layer group. Potential for the CAGE layer group is generally nil in these areas.

APOCYNUM ANDROSAEMIFOLIUM LAYER GROUP (APAN L.G.)

Apocynum is a rhizomatous forb that can develop a substantial coverage in full sun or partial shade. Since it is highly unpalatable to livestock, it can withstand light to moderate grazing. There is no indication that *Apocynum* can store its seed in the soil (Kramer 1984).

Veratrum californicum is a tall, rhizomatous forb that can maintain substantial coverages beneath partial shade. Like *Apocynum* it has low palatability to livestock and can withstand considerable

Figure 21—An EPAN-CARU herb layer type north of Idaho City, ID, in 1985. This area experienced a wildfire 6 years ago. *Epilobium* has increased in response to the burning and is well represented. *Calamagrostis* has regained dominance of the herb layer through its rhizomatous growth habit.

grazing. Black bears, however, eat the thick shoots in late spring. *Veratrum*'s seed storage capability remains unknown. Occasionally, it becomes well represented in PSME/CARU (fig. 22) and is considered an alternate indicator of the APAN layer group.

The APAN layer group occurs only in the PIPO phase, probably reflecting warmer conditions. APAN layer types appear to have evolved from early seral layer types rather than directly from a particular disturbance. However, the early seral conditions that give rise to APAN layer types result mainly from scarification and grazing. The grazing pressures often continue as shade increases, leaving an APAN layer type on the site. When these layer types occur on recently disturbed sites, they appear to have survived the disturbance rather than resulted from it.

FRAGARIA VESCA LAYER GROUP (FRVE L.G.)

Fragaria vesca and *F. virginiana* can develop substantial coverages through their stoloniferous growth habit. This occurs most often beneath a light canopy of trees or tall shrubs where partial shade reduces competition from early seral herb layer species. In clearcut areas that have developed a shrub layer, *Fragaria* often develops high coverages beneath the canopies of large shrubs. The spaces between shrubs support species such as *Potentilla* and *Geranium* that are more indicative of disturbance and full sunlight. *Fragaria virginiana* occurs mainly on the cooler, more frost-prone areas. It is treated as a successional equivalent of *F. vesca*. Small amounts of *F. vesca* seed will remain viable in the soil (Kramer 1984), but most of the seed is likely dispersed by birds and mammals. Apparently the seedlings require bare, shaded soil for establishment. *Fragaria* is moderately palatable to deer, elk, and sheep. Its leaves remain green through the winter, providing better winter forage than most herb layer species. The fruits ripen in midsummer, when they are sought by black bear, grouse, and various songbirds.

FRVE layer types were found in the PIPO and CARU phases of PSME/CARU but were scarce in the FEID phase. These sites had been clearcut or partially logged 10 to 46 years ago. Most had been scarified or burned. It appears that FRVE layer types do not result from a particular disturbance, but are simply a midseral stage of herb layer succession following various disturbances. FRVE layer types probably cannot be created directly from site

Figure 22—An APAN-CARU herb layer type northwest of Prairie, ID, in 1988. The site was partially cut 10 years ago and well scarified during logging. Since then, it has been repeatedly grazed by cattle. *Veratrum californicum*, an alternate indicator of *Apocynum*, has increased in response to the grazing. *Arnica cordifolia*, *Calamagrostis*, *Poa nervosa*, and *Poa compressa* are also prevalent.

treatment but might be maintained through repeated partial cutting.

LUPINUS SPP. LAYER GROUP (LUP. L.G.)

Several species of *Lupinus* can become well represented in PSME/CARU. *Lupinus caudatus* and *L. sericeus* are the primary species, but *L. argenteus* and *L. wyethii* may also occur in cooler portions of the habitat type. The species are seldom mixed. Their occurrence appears related to minor site differences. These lupines are nonrhizomatous, deep-rooted perennials that can persist under partial shade. They produce a relatively heavy seed that is probably not widely dispersed. It is likely to be stored in the soil.

Lupinus layer types are most common in the CARU phase but can also be found in the PIPO phase. In both phases, partial cutting or clearcutting had occurred 4 to 19 years ago on most sites. Most sites also had been scarified. The most common treatment was a partial cut followed by scarification of a CAGE or CARU layer type that contained small amounts of *Lupinus*. Their deep root systems enabled the lupines to survive the scarification. Afterward, their cover increased due to more sunlight and less competition. Some increase from buried seed also may have occurred. Partial cutting followed by cattle grazing might produce similar results.

CAREX GEYERI LAYER GROUP (CAGE L.G.)

Carex geyeri is a moderately shade-tolerant sedge found in many habitat types. It tends to grow in a bunch form, especially on dry, granitic substrates, but also develops a loose rhizomatous form on wetter sites. Its extensive root system is an effective soil stabilizer even on steep granitic slopes. It is also a strong competitor with other plants, including tree seedlings. *Carex geyeri* has some ability to store seed in the soil (Kramer 1984). The stored seed apparently germinates best following clearcutting and scarification, but can also germinate following burning. Burning appears to reduce the existing sedge cover, but not as much as mechanical scarification. *Carex geyeri* is one of the first plants to become active in spring. The new growth provides considerable forage value for elk and bear (appendix B). The ability to grow during the low temperatures of spring enables *C. geyeri* to deplete soil moisture and go dormant before other plants can make use of the moisture. This *Carex* generally persists in older stands but gives way to its common associates, *Calamagrostis rubescens* and *Arnica* with increasing shade. *Carex geyeri* represents late seral stages of PSME/CARU succession but may occupy a climax role near the habitat type's dry extremes.

Aster conspicuus is a moderately shade-tolerant forb that can maintain extensive colonies beneath pine and Douglas-fir. It can increase vegetatively by rhizomes, developing high coverages when the tree canopy is reduced. Apparently, it also increases after burning. It is one of the first herb layer species to resprout after a wildfire. Its wind-transported seed disperses long distances, probably germinating on bare soil. In this manner, small amounts of *Aster* can establish after stand-destroying wildfire or clearcutting with scarification. Afterward, the *Aster* can increase vegetatively to form extensive colonies which persist on well-timbered sites. They give way to *Calamagrostis* with increasing shade. *Aster conspicuus* is considered an indicator of late seral conditions, similar to *Carex geyeri*.

Poa nervosa is a shade-tolerant, rhizomatous grass that is often present in older stands of PSME/CARU. It can persist along with *Carex geyeri* in the CARU layer type where neither species is well represented. This *Poa* occurs as small patches, reproducing vegetatively under mature canopies of *Pseudotsuga*. With increased sunlight, it can expand its coverage and flower. After thinnings and shelterwood cuts, *Poa* increases more rapidly than *Carex geyeri* and occasionally becomes well represented.

CAGE layer types are prevalent in both the PIPO and CARU phases of PSME/CARU. They occur on sites that have been disturbed as recently as 6 years ago (fig. 23), as well as sites undisturbed for many decades. Most of the recently disturbed sites had been clearcut or partially cut and scarified. A few sites had been broadcast burned. The undisturbed sites (mostly CAGE-CARU layer type) occurred near the dry extreme of PSME/CARU and probably represent a climax herb layer. On the moister sites, CAGE layer types apparently can result from light scarification of *Calamagrostis* sod under partial shade. This response was most common on granitic substrates but also occurred on sedimentary sites.

CALAMAGROSTIS RUBESCENS LAYER GROUP (CARU L.G.)

Calamagrostis rubescens is a rhizomatous grass that can maintain high coverages under fairly dense shade as well as in openings. With increased sunlight the *Calamagrostis* can acquire new vigor and increase its coverage. This response is most likely to occur in moister portions of the habitat type. At the dry extremes, *Calamagrostis* may not increase with sunlight. Minor scarification may even reduce *Calamagrostis* in full sun. It has high spring-summer forage value for bear and elk (appendix B).

Arnica cordifolia and *Antennaria racemosa* are included as alternate indicators of the CARU l.g. even though they are seldom needed. *Arnica* can increase by rhizomes but is seldom as aggressive as *Calamagrostis*. *Antennaria* increases by stolons but usually requires some shade. It occurs mainly on the wetter

Figure 23—A CAGE-CARU herb layer type southwest of Placerville, ID, in 1986. This area received a partial cut and thorough scarification 6 years ago. *Carex geyeri* has increased from buried seed and *Calamagrostis* has spread by rhizomes. They now codominate the herb layer.

sites. Both species are likely to increase vegetatively following partial reduction of the tree canopy. However, neither species increases profusely from seed after disturbance. Like most wind-dispersed species, *Arnica* and *Antennaria* do not store seed in the soil. *Arnica* has moderate forage value for deer and elk, while *Antennaria* has moderate value only for deer.

The CARU l.g. consists of only one layer type and is considered climax wherever found in PSME/CARU. This layer type generally results from successional advance rather than a particular site treatment. However, an ineffective site treatment may allow a CARU layer type to remain, making tree regeneration difficult (fig. 24). Most of these sites had experienced little or no disturbance for many decades. A few sites had been burned recently, but the *Calamagrostis* and *Arnica* simply resprouted. Most of these sites were receiving little or no livestock use.

MANAGEMENT IMPLICATIONS

Management implications were derived from data and repeated field observations during this study and the habitat type study (Steele and others 1981). Users should keep in mind the often small sample size of the data set and the minimal amount of field testing and user response.

Natural Tree Establishment and Related Microsites

Naturally established tree seedlings were recorded by species, silvicultural treatment, and microsite conditions. A seedling was defined as a tree less than 4.5 ft (1.4 m) tall and at least 3 years old that began growing after the disturbance.

A total of 286 naturally established *Pinus contorta*, *Pinus ponderosa,* and *Pseudotsuga menziesii* seedlings were recorded in seedling plots in the PIPO phase, while 205 *Pinus contorta* and *Pseudotsuga menziesii* seedlings were recorded for the CARU phase. This represented 965 seedlings per acre (2,390 per hectare), mostly of *Pinus ponderosa*, in the PIPO phase and 721 seedlings per acre (1,786 per hectare), mostly of *Pinus contorta*, in the CARU phase.

Seedbeds and covers comprise the major microsite components for natural regeneration. The amount of a particular seedbed or cover varies depending on the amount of area occupied by individual microsite components. We determined the regeneration efficiency (RE) values of seedlings in different microsites

Figure 24—A CARU-CARU herb layer type southeast of Placerville, ID, in 1986. A partial cut occurred here 11 years ago, and much of the area was lightly scarified during logging. *Arnica cordifolia* and *Calamagrostis* survived the scarification and have increased from rhizomes. Now they codominate the herb layer.

using ratio analysis (Groot 1988). To calculate the RE value (ratio), the percentage of seedlings occurring on or under a microsite component was divided by the percentage of the area occupied by the component. An RE value of 1.00 indicates that the seedlings occurred in a particular microsite in proportion to that microsite's occurrence. RE values were then assigned to one of the following five classes: class 1: 0 to 0.25, very inefficient; class 2: 0.26 to 0.75, inefficient; class 3: 0.76 to 1.50, efficient; class 4: 1.51 to 3.00, more efficient; class 5: 3.01 and greater, very efficient. Other summaries, including occurrence of seedlings under various silvicultural methods, site preparation methods, and tree and shrub layer groups, are expressed as percent occurrence for a species based on the average number of seedlings per treatment.

Microsites for natural regeneration were determined after germinants became established. We could not determine the exact conditions in which the seedlings became established. Groot's study of seedbed receptivity analysis methods (1988) indicates ratio analysis can be feasible on sites where seedbeds do not change much over time. In our study, the seedbed categories were bare mineral soil, litter-covered mineral soil, moss mats, rotten wood, and residual duff. Bare mineral soil, rotten wood, and residual duff seedbeds probably would not change much between disturbance and our recording of seedlings on a microsite. We could not determine when seedlings became established on seedbeds now composed of litter-covered mineral soil or moss mats. The litter of litter-covered seedbeds may retard soil surface evaporation rates. Some investigations have shown that litter-covered mineral soil may be important as a seedbed for regeneration (Day and Duffy 1963; Krauch 1956), especially in dry environments. Moss mats also have properties that may enhance seedling germination and establishment (Day and Duffy 1963).

The relationship between microsite covers and seedlings was much more difficult to determine. The microsites of seedlings found without covers or under slash were likely the same microsites in which the seed germinated. In the case of seedlings under vegetation cover, however, the tree seedling and microsite cover may have benefited from the same initial microsite conditions and established near one another coincidentally. In other cases, the tree seedling may have benefited from the existing vegetation cover, which may provide favorable microsite conditions for shade, soil moisture and nutrients, humidity, temperature, and wind protection (Zavitkovski and Woodard 1970). Investigations of natural regeneration in other areas found

that some species, including conifers, require protected microsites for germination and initial establishment, particularly in hot, dry environments (Day 1964; Minore 1986, 1987; Roeser 1924). Additionally, some microsite covers may favor one seedling species but not another. A heavy canopy cover may favor shade-tolerant tree species over intolerant species. An allelopathic cover species may deter establishment of some tree seedlings. Once the relationship between canopy cover and the success or failure of particular seedlings is known, the canopy cover species may indicate which microsites are likely to be favorable or unfavorable.

Although RE values may reflect a relationship between the microsite and tree seedlings, several factors affect the interpretation of these values. We assumed seedlings persist only in favorable microsites; if a seed germinates in a favorable microsite, it should die if the microsite deteriorates, through rapid shrub development, for instance. Some seedlings recorded in unfavorable microsites may have perished later. Therefore, some microsites identified as beneficial may not allow mature trees to develop.

Pinus contorta—Most natural regeneration of *Pinus contorta* (48 percent) occurred under shelterwood cuts, even though the average distance to a seed source was farthest on these sites (table 8). Seed sources were closest in seedtree cuts, where only 23 percent of the seedlings were found. More regeneration (40 percent) occurred on sites that had been lightly scarified (table 9), either from slash piling or logging; only 3 percent of the seedlings occurred on sites that had been heavily scarified by contour terracing or contour stripping. Broadcast-burned sites accounted for 32 percent of the regeneration, followed by sites without site preparation (25 percent). While moss mats had the highest regeneration efficiency for *P. contorta* (table 10), litter-covered and bare mineral soil and residual duff (composed of *P. contorta* needles) were all efficient seedbeds.

Sixty-eight percent of the *Pinus contorta* seedlings were in the open, away from the grasses and sedges that were the predominant understory microsite covers on the site (table 11). *Pseudotsuga menziesii* was a very efficient cover for *Pinus contorta,* while *Pinus contorta* and *Spiraea betulifolia* were efficient. Covers of slash, *Ribes*, *Symphoricarpos*, and *Salix scouleriana* were all inefficient or very inefficient. Most seedlings were found under a PICO tree layer group in both the PIPO and CARU phases (table 12). More than half the *Pinus contorta* seedlings were on sites without a shrub layer in both phases (table 12). The RICE layer group accounted for about 30 percent of the regeneration, even though *Ribes* was an inefficient cover.

Pinus contorta occurs at its dry limits in the PSME/CARU h.t. and appears to require some site protection by an overstory. Seed-tree cuts to open shelterwood cuts of 10 to 30 *P. contorta* per acre should regenerate well to *P. contorta* seedlings. Sites should be treated to provide mineral soil over 60 to 70 percent of the area. Because *P. contorta* cones have little serotiny in central Idaho, burning is not needed for regeneration.

Pinus ponderosa—Regeneration of *Pinus ponderosa* occurred predominantly (94 percent) under shelterwood cuts, which had the closest average distance to a seed source (table 8). No seedlings were found under seed-tree cuts, possibly due to the lack of seed; the average distance to a seed source was 180 ft (55 m). While only a small number of seedlings were found under single-tree selection cuts (5 percent), single-tree selections had the second closest average seed source (45 ft, 14 m). One percent of the seedlings occurred in clearcuts, where the average distance to a seed source was 149 ft (45 m). The large numbers of seedlings under shelterwood cuts may be due to the nearby seed source, the ameliorated environment created by the overstory, or their combination.

Most of the *Pinus ponderosa* seedlings (56 percent) were found on sites that had been lightly scarified (table 9). Litter-covered mineral soil was a more efficient seedbed for *P. ponderosa* seedlings; all other seedbeds were inefficient or very inefficient (table 10). Most of the seedlings (78 percent) occurred in the open (table 11). *Pinus ponderosa*, *Ceanothus velutinus*, *Salix scouleriana,* and *Amelanchier alnifolia* were efficient covers for regeneration. Seedlings also occurred under grasses and sedges, forbs, slash, *Symphoricarpos*, and *Populus,* though these covers were inefficient or very inefficient. Even though most seedlings did not occur directly under a microsite cover, most were under shelterwoods, particularly shelterwoods in the PIPO layer group (table 12). Most seedlings (84 percent) occurred on sites without a shrub layer. Nine percent of the seedlings were under the CEVE layer group.

On some sites, seed caches may play an important role in *Pinus ponderosa* establishment. Several rodent and bird species, including many common in central Idaho, cache conifer seeds. The deer mouse (*Peromyscus maniculatus*) and golden-mantled ground squirrel (*Spermophilus lateralis*) commonly store seeds in caches just below the soil surface (Abbot and Quink 1970; Saigo 1969). The yellow-pine chipmunk (*Eutamias amoenus*) caches seed in both surface caches (Broadbooks 1958; West 1968) and in underground nest cavities (Broadbooks 1958). Several bird species of the crow family, which includes the Steller's jay (*Cyanocitta stelleri*), pinyon

Table 8—Occurrence of natural tree seedlings (percent) by silvicultural method and overstory composition for the PSME/CARU h.t., PIPO and CARU phases

Silvicultural method Overstory composition	Number of sites	Present tree cover[1]	Average distance to seed source[2]	Average distance to seed source for plots with seedlings	Present basal area	Natural tree seedlings: *Pinus contorta*	Natural tree seedlings: *Pinus ponderosa*	Natural tree seedlings: *Pseudotsuga menziesii*
		Percent	*Feet*	*Feet*	*Feet*	*Percent*	*Percent*	*Percent*
Clearcut	[3]25				17	13	1	8
Pinus contorta		<1	72	11				
Pinus ponderosa		9	149	75				
Pseudotsuga menziesii		2	166	62				
Seedtree cut	6				19	23	0	11
Pinus contorta		2	15	8				
Pinus ponderosa		2	180	—				
Pseudotsuga menziesii		12	59	[4]0				
Shelterwood cut	31				65	48	94	78
Pinus contorta		3	81	36				
Pinus ponderosa		16	23	21				
Pseudotsuga menziesii		11	61	52				
Single-tree selection cut	6				24	16	5	3
Pinus contorta		<1	65	[5]100				
Pinus ponderosa		19	45	[5]35				
Pseudotsuga menziesii		7	36	[5]35				

[1]Percent canopy cover of trees >4 inches d.b.h.
[2]Distance from center of 375-m^2 plot to seed source; immature trees often comprised overstory composition.
[3]Number of sites from PIPO phase: 12 clearcuts, 2 seed-tree cuts, 14 shelterwood cuts, 4 selection cuts.
[4]Seed source on plot.
[5]Data from only one plot.

Table 9—Occurrence of natural tree seedlings (percent) by site preparation method for the PSME/CARU h.t., PIPO and CARU phases

	Site preparation method			
		Broadcast	Scarification	
	None	burn	Light[1]	Heavy[2]
Percent of microplots	9	13	72	6
Percent of site disturbed	8	68	80	83
Pinus contorta	25	32	40	3
Pinus ponderosa	13	31	56	0
Pseudotsuga menziesii	54	17	24	5

[1]Scarification from slash piling or logging activities.
[2]Disturbance from logging activities and contour terracing or stripping.

jay (*Gymnorhinus cyanocephalus*), and Clark's nutcracker (*Nucifraga columbiana*), cache seed (Halvorson 1986). Seeds left in these caches can germinate, establishing conifer regeneration. Multiple seedlings of *Pinus ponderosa* at the same spot were recorded as seed caches. The results may underestimate the number of seed-cache seedlings since some individual seedlings may have resulted from seed caches. The seed caches probably resulted from a combination of birds and rodents, though one or the other may have been more important on individual sites.

In Oregon's Cascade Range, West (1968) found that 15 percent of the *P. ponderosa* seedlings resulted from rodent caches. In central Idaho, McConkie and Mowat (1936) reported that 14 percent of *P. ponderosa* seedlings resulted from rodent caches. In the Douglas-fir/mountain maple h.t., 31 percent of the regeneration apparently resulted from seed caches (Steele and Geier-Hayes 1989). In the Douglas-fir/elk sedge h.t., ponderosa pine phase, 22 percent of the *P. ponderosa* regeneration occurred in seed caches (Steele and Geier-Hayes 1987). The occurrence was similar in the Douglas-fir/white spirea h.t. (16 percent) and grand fir/blue huckleberry and grand fir/mountain maple h.t.'s (both 17 percent) (Geier-Hayes 1987).

However, in the PSME/CARU h.t., PIPO phase, only 2 percent of the *P. ponderosa* seedlings were found in seed caches. When Hoffman (1960) surveyed small mammals in climax vegetation in eastern Washington and northern Idaho, he collected only one rodent, a shrew (*Sorex vagrans*), from a Douglas-fir/pinegrass site. Although shrews are insectivorous, they will eat conifer seeds (Sullivan and Sullivan 1982; Terry 1978). However, they are not known to cache seed. Rickard (1960) conducted a study similar to Hoffman's in a different set of habitat types. He and Hoffman both collected individuals of several seed-caching species in other habitat types nearby. Rodents may have been missing in the PSME/CARU h.t. due to the lack of cover. Many rodents prefer areas protected by vegetation or debris (Van Horne 1982). Though rodents might migrate into disturbed sites with shrub cover in the PSME/CARU h.t., especially sites with shrubs the rodents feed on, they may not collect conifer seed from surrounding stands if those areas are predominantly climax PSME/CARU layer types.

Seed-caching birds may also avoid PSME/CARU sites. Clark's nutcracker, the most extensively studied seed cacher (Halvorson 1986), rarely chooses caching sites that resemble PSME/CARU h.t. Most

Table 10—Regeneration efficiency (RE) classes[1] of seedbeds for natural tree seedlings in the PSME/CARU h.t., PIPO and CARU phases

	Mineral soil					
Species	Scarified and litter-covered	Scarified and bare	Moss mats	Rotten wood	Residual duff	Rocks or stumps
Pinus contorta	3	3	5	—	3	—
Pinus ponderosa	4	1	1	2	—	—
Pseudotsuga menziesii	3	2	5	2	1	—
Seedbed occurrence[2]	56	30	4	1	7	2

[1]RE classes: 1 = 0-0.25, very inefficient; 2 = 0.26-0.75, inefficient; 3 = 0.76-1.50, efficient; 4 = 1.51-3.00, more efficient; 5 = 3.01+, very efficient.
[2]Percent occurrence of seedbed in all plots.

Table 11—Regeneration efficiency (RE) classes[1] of shrub cover and other microsites for natural tree seedlings in the PSME/CARU h.t., PIPO and CARU phases

Type of cover	Constancy	Area occupied	*Pinus contorta*	*Pinus ponderosa*	*Pseudotsuga menziesii*
	Percent		*RE*		
None[2]					
Grasses and sedges	99.6	39	1	1	2
Forbs	99.6	20	1	1	1
Slash	79.1	14	2	1	2
Pinus ponderosa	13	5	—	3	3
Ribes spp.	33	5	2	—	2
Ceanothus velutinus	18	4	—	3	4
Symphoricarpos spp.	7	3	1	2	2
Pinus contorta	13	3	3	—	2
Salix scouleriana	11	2	1	3	4
Populus tremuloides	9	1	—	2	3
Pseudotsuga menziesii	11	1	5	—	4
Purshia tridentata	9	1	—	—	—
Amelanchier alnifolia	9	1	—	3	4
Spiraea betulifolia	8	1	3	—	3
Arctostaphylos uva-ursi	2	<1	—	—	—
Berberis repens	7	<1	—	—	—
Vaccinium scoparium	1	<1	—	—	—
Shepherdia canadensis	<1	<1	—	—	—
Sorbus scopulina	<1	<1	—	—	—
Chrysothamnus spp.	<1	<1	—	—	—
Artemisia tridentata	<1	<1	—	—	5
Prunus spp.	<1	<1	—	—	—
Rosa spp.	<1	<1	—	—	—

[1]RE classes: 1 = 0-0.25, very inefficient; 2 = 0.26-0.75, inefficient; 3 = 0.76-1.50, efficient; 4 = 1.51-3.00, more efficient; 5 = 3.01+, very efficient.

[2]During sampling no estimate of "none" type of cover was made for each plot, therefore, no RE value could be calculated. However, 68 percent of the *Pinus contorta*, 78 percent of the *Pinus ponderosa*, and 53 percent of the *Pseudotsuga menziesii* seedlings were found under no cover.

often, Clark's nutcracker chooses steep, southerly aspects with little herbaceous vegetation (Tomback 1982; Vander Wall and Balda 1977). In a study by Tomback (1978), Clark's nutcracker never cached seeds in grasses or sedges. Therefore, both the terrain features and the dominating grass cover in the PSME/CARU h.t. may preclude seed caching by birds.

The selection of a silvicultural method to regenerate *Pinus ponderosa* naturally should first address the proximity of *P. ponderosa* seed sources within the stand. Shelterwood cuts (of 10 to 30 trees per acre) may be necessary to ameliorate site conditions. Seedlings will probably regenerate on sites which have been scarified or underburned. Small quarter-acre or half-acre openings that are broadcast burned may also regenerate *Pinus ponderosa,* since *Ceanothus* is an efficient cover species for *P. ponderosa* seedlings. Most regeneration will likely occur within 100 ft (30 m) of the seed source. The sites should be treated so that mineral soil occurs over 80 to 90 percent of the area.

Pseudotsuga menziesii—Most natural regeneration of *Pseudotsuga* also occurred under shelterwood cuts (78 percent) where the average distance to a seed source was 61 ft (19 m) (table 8). Seed sources were closest for single tree selection cuts, but only 3 percent of the regeneration occurred there. Clearcuts, where 8 percent of the seedlings were found, had the longest average distance to a seed source.

More than half the seedlings occurred on sites without site preparation (table 9). However, residual duff was a very inefficient seedbed (table 10). Most seedlings were found on moss mats, a very efficient seedbed for *Pseudotsuga.* Scarification treatments accounted for more than one-quarter of the seedlings (table 9); litter-covered mineral soil was an efficient seedbed for regeneration.

More than half the seedlings occurred in the open (table 11). *Artemisia tridentata* was a very efficient cover; *Ceanothus velutinus*, *Salix scouleriana*, *Pseudotsuga menziesii*, *Amelanchier alnifolia*, *Pinus ponderosa*, *Populus tremuloides*, and *Spiraea*

Table 12—Occurrence of natural tree seedlings (percent) by tree and shrub layer groups in the PSME/CARU h.t., PIPO and CARU phases

	Tree seedlings						
	PIPO phase				CARU phase		
	Percent of stands	*Pinus contorta*	*Pinus ponderosa*	*Pseudotsuga menziesii*	Percent of stands	*Pinus contorta*	*Pseudotsuga menziesii*
Average number of seedlings per acre		132	678	155		447	274
Tree layer groups							
Depauperate	18	3	3	20	20	1	4
POTR	3	0	20	0	3	13	0
PICO	12	77	0	4	23	63	45
PIPO	61	20	73	32	N/A	—	—
PSME	6	0	4	44	54	23	51
Shrub layer groups							
Depauperate	37	57	84	27	54	74	39
ARTR	N/A	—	—	—	8	0	54
PUTR	13	0	1	3	N/A	—	—
CEVE	28	2	9	37	3	0	0
RICE	13	31	3	7	30	26	7
SASC	6	10	3	26	N/A	—	—
PRVI	0	—	—	—	N/A	—	—
SYOR	3	0	0	0	5	0	0

betulifolia were more efficient or efficient covers for regeneration. Grasses and sedges, forbs, slash, *Ribes*, *Symphoricarpos*, and *Pinus contorta* were inefficient or very inefficient covers. Both the PSME and PICO tree layer groups supported regeneration (table 12), even though PICO was an inefficient cover for seedlings. More than half the regeneration occurred on sites with an ARTR shrub layer group (table 12). Many seedlings also occurred on sites with a depauperate shrub layer group.

Shelterwood cuts of 25 to 35 trees per acre should regenerate well with *Pseudotsuga* seedlings. Sites without site preparation supported the most seedlings. But scarification treatments likely will regenerate seedlings more reliably, since residual duff is a very inefficient seedbed. Scarification treatments also promote the establishment of moss mats, a very efficient seedbed for *Pseudotsuga*. Treatments that expose mineral soil over 80 to 90 percent of the area should regenerate.

Planted Tree Establishment

Planted sites were identified from plantation signs and obvious rows of even-aged trees. The percentage of tree survival was estimated for each site preparation technique. Site preparation included no preparation, hand scalps, scarification with and without burning, and contour terraces. Hand scalping was grouped with no preparation. It usually did not reduce long-term competition, and it could not always be recognized in older plantations. Scarification treatments usually resulted from stripping, piling and burning, or extensive machinery traffic during logging. Contour ditches were grouped with terraces because they similarly displaced soil and buried seeds and competing root systems. Survival and growth of tree seedlings was similar for ditches and terraces.

Contour terraces were used to establish ponderosa pine seedlings during the 1950's and 1960's. Initially, the terraces were used where vigorous competing vegetation had developed after extensive wildfires in the early 1930's. Eventually, terraces were used throughout a variety of site conditions. In some areas, the terraces led to excessive soil movement. After adverse public opinion, terracing was discontinued, despite its overall success as a reforestation technique. Contour ditching had been used in many areas rather than terraces. The ditches were usually built with a large plow. They were effective in establishing tree seedlings where the residual plant competition was short, such as pinegrass, elk sedge, spirea, and common snowberry. Contour ditching was also effective where ninebark had become established, so long as the shrubs were relatively low. The ditches displaced

considerably less soil than the terraces, with less visual impact. Unfortunately, use of contour ditches was discontinued when the terraces earned disfavor.

In the PIPO phase of PSME/CARU, planted *Pinus ponderosa* seedlings were most likely to survive (about 44 percent after 16 years) on contour terraces or ditches (table 13). Planted *P. contorta* might also be more likely to survive on contour terraces or ditches, but we couldn't collect enough data to support that conclusion. The terraces and ditches apparently improve soil moisture by concentrating surface runoff and by removing the seeds and root crowns of competing plants. Relatively high survival of planted pines on terraces and ditches has also been recorded in other Douglas-fir habitat types (Curtis and Coonrod 1960; Hall and Curtis 1970; Steele and Geier-Hayes 1986, 1989).

Survival of planted *Pseudotsuga*, however, is apparently not enhanced by terraces or ditches. These site treatments leave the planting spot too exposed to sun and wind for adequate survival. Although data are sparse for the PIPO phase, *Pseudotsuga* survival in the CARU phase appears greatest on sites that have been broadcast burned (table 14). Broadcast burning tends to provide more site protection for tree seedlings than the other treatments. Logs and large tree limbs that remain on the site and the resprouting shrubs all provide site protection for *Pseudotsuga* seedlings. Dead trees and snags also provide important shade for tree seedlings. They could be left standing on areas to be burned to benefit the seedlings as well as birds and small mammals.

For *Pinus ponderosa*, broadcast burning did not substantially increase survival (table 13). The pine requires more sunlight than *Pseudotsuga*. Burning often increases competition for light by stimulating certain species to sprout vigorously or germinate from buried seed. Unless pine seedlings are planted the spring following burning, the planted trees are at a serious disadvantage. Pine plantations that are successful on broadcast-burned sites often appear more vigorous than plantations prepared by hand scalping or machine scarification. *Pinus ponderosa*

Table 13—Success of tree plantations by site treatment in the PSME/CARU h.t., PIPO phase

Tree species	Site treatment[1]			
	None, includes hand scalps	Broadcast burning	Scarified unburned, includes stripping	Contour terraces, includes ditching
	Survival of planting, percent (average age)[2]			
PIPO	23(15) $n = 3$	29(26) $n = 3$	26(15) $n = 8$	44(16) $n = 9$
PSME	1(10) $n = 1$	— —	0(9) $n = 2$	2(5) $n = 1$
PICO	—	—	10(8) $n = 3$	60(5) $n = 1$
	Average age to breast height, years			
Planted[3]				
PIPO	11 $n = 3$	9 $n = 4$	12 $n = 8$	8 $n = 8$
PSME	—	—	—	—
PICO	—	7 $n = 1$	7 $n = 1$	5 $n = 1$
Natural				
PIPO	—	—	—	—
PSME	—	10 $n = 2$	15 $n = 2$	—
PICO	—	—	9 $n = 2$	—

[1]n = number of sample sites.
[2]Plantings less than 4 years old were omitted; complete plantation failures and multispecies plantings could not be sampled for survival.
[3]Nursery years are not included.

Table 14—Success of tree plantations by site treatment in the PSME/CARU h.t., CARU phase

Tree species	Site treatment[1] None, includes hand scalps	Broadcast burning	Scarified unburned, includes stripping	Contour terraces, includes ditching
	Survival of planting, percent (average age)[2]			
PICO	50(10) *n* = 2	—	20(5) *n* = 2	—
PSME	16(9) *n* = 4	23(17) *n* = 5	6(16) *n* = 4	3(20) *n* = 2
	Average age to breast height, years			
Planted[3]				
PICO	10 *n* = 2	—	9 *n* = 1	—
PSME	—	13 *n* = 3	10 *n* = 1	15 *n* = 1
Natural				
PICO	—	8 *n* = 1	8 *n* = 2	—
PSME	17 *n* = 1	15 *n* = 2	—	—

[1]*n* = number of sample sites.
[2]Plantings less than 4 years old were omitted; complete plantation failures and multispecies plantings could not be sampled for survival.
[3]Nursery years are not included.

reached breast height 9 years after broadcast burning, while it took 11 years after scalping, or 12 years after scarification (table 13). It is not clear what causes the difference in vigor, since several variables are involved. Field observations suggest, however, that burning increases vigor on most severe sites where *Pinus ponderosa* is planted.

Machine scarification (with the "Salmon blade") is appropriate for natural tree regeneration in partially cut stands. But for clearcut areas, machine scarification (by bulldozer-piling or contour stripping) is not recommended. These treatments may initially reduce competition for tree seedlings but also displace a lot of soil, have the largest gopher populations, and provide the least forage for deer, elk, and black bear. Extensive machine scarification in clearcuts should be necessary only where a residual shrub layer will resprout, presenting severe competition for pine seedlings. Pinegrass and elk sedge only need to be eliminated in the spots where seedlings are planted. Concentrations of slash can be fall-burned to heat the soil and kill the graminoids, or the area can be machine scalped intermittently, as with the Birch scalper. The intervening areas of pinegrass and elk sedge help maintain soil stability and keep the habitat unfavorable for pocket gophers.

The survival percentages in tables 13 and 14 may differ considerably from Ranger District records. These data reflect planting attempts over many years. Many early planting failures were due to factors other than site treatment and habitat type. The data reflect seedling success over the past 10 to 30 years. District records, generally maintained for only a few years after planting, do not reflect the long-term effects of site and competition. Our figures do not necessarily indicate the highest possible survival rates. Occasionally, high survival rates have been achieved in several treatment categories. Our survival rates are best interpreted as the relative probability of success among treatments rather than the exact expected percentage of survival.

Growth and Yield

Age to Breast Height—The years required for a tree to reach breast height (4.5 ft, 1.4 m) can be a critical factor in estimating the growth and yield of forest stands, as well as seedling success against competing vegetation. Normally an estimated

constant is used for a given species. Yet for some species, the breast height ages have varied considerably between site treatments within a habitat type. In PSME/CARU, data are sparse for most categories. For *Pinus ponderosa* (table 13), breast height ages appear to be less where planted on contour terraces or ditches, or on broadcast burns. Machine scarification and hand-scalping treatments may extend breast height ages an extra 3 to 4 years.

Site Index and Yield Capability—Height-age data of free-growing trees, usually in clearcuts or burns, were collected during the course of this study. Free-growing trees are not suppressed by other trees or shrubs. These data provided growth information for the younger age classes of major tree species in PSME/CARU. Similar data in older age classes were taken from dominant or codominant trees in older stands during this study and the habitat type classification study (Steele and others 1981). Increment cores of older trees were examined for evidence of suppression. If the core indicated past suppression, or if the core was too far from the pith to allow the age to be estimated with confidence, the tree was rejected.

Three sources were used to estimate site index and yield capability. The *Pseudotsuga* site index was plotted from Monserud's (1985) site curves. Because no yield tables exist for *Pseudotsuga*, we used Brickell's (1970) ponderosa pine yield curve. The *Pinus ponderosa* site index and yield capability were derived from Brickell's (1970) site curves, which are a conversion to a 50-year base age from Lynch (1958). The *Pinus contorta* site index and yield capability were derived from Brickell (1970).

Growth and yield capabilities of the PSME/CARU h.t. are shown in table 15. Ponderosa pine apparently produces more volume than Douglas-fir in the PIPO phase. Lodgepole pine produces less volume than Douglas-fir in both phases. This is probably because the lodgepole pine is growing at the warm, dry extreme of its range in PSME/CARU.

Pocket Gophers

It has long been known that pocket gophers (*Thomomys talpoides*) can damage pine plantations (Dingle 1956; Moore 1943). In summarizing past studies, Teipner and others (1983) suggest that gopher damage to young pines may be related to the amount and composition of associated plant species, as well as gopher density. Our studies indicate that species composition can vary with the type of site preparation, which, in turn, may influence gopher populations. Pocket gopher mounds are an indication of gopher activity (Richens 1965). We tallied gopher mounds in our sample and summarized their numbers by site treatment.

Pocket gophers are not a widespread problem in the PSME/CARU h.t. They are especially sparse in the CARU phase, where cooler temperatures limit forb development. High gopher densities may occur in either phase, however, when stands with gopher populations are logged. These stands often support early seral herbaceous species as a result of past disturbance. The early seral herbs can result from gap succession caused by minor disturbances such as windthrow, prior partial cutting of the stand, or severe livestock use. Clearcutting increases the early seral herbaceous vegetation, benefiting the gophers.

Table 15—Site index and yield capability of trees in the PSME/CARU h.t.

Tree species	Number of site trees	Site index (50-year base)	Number of stands	Yield capability
				Cubic feet/ acre/year
PIPO phase				
Pseudotsuga menziesii	13	56 ± 7[1]	13	72 ± 14
Pinus ponderosa	18	61 ± 5	18	83 ± 11
Pinus contorta	8	30 ± 8	8	24 ± 9
CARU phase				
Pseudotsuga menziesii	17	52 ± 5	17	64 ± 9
Pinus contorta	4	50 ± 10	4	54 ± 20

[1]95 percent confidence intervals.

The type of site preparation treatment can also influence herb layer composition and gopher populations. In the PIPO phase of PSME/CARU, scarification without burning results in the greatest amount of gopher activity (fig. 25). This type of scarification usually results from machine piling of logging debris, but can also result from severe trampling by livestock. This may account for correlations between heavy grazing and high gopher activity observed in other areas (Buechner 1942). In either case, an early seral herbaceous layer is produced that should be avoided if pine plantations are planned. In contrast, burning without scarification can produce a depauperate herb layer by generating a dense shrub layer. The burning also tends to produce mid to late seral herb layers, because survivors of the burn resprout and often dominate the site. Burning creates fewer seedbeds for early seral herbaceous species than scarification.

In the CARU phase, the type of site treatment has less effect on gopher populations (fig. 26). This is probably because site treatment has less effect on

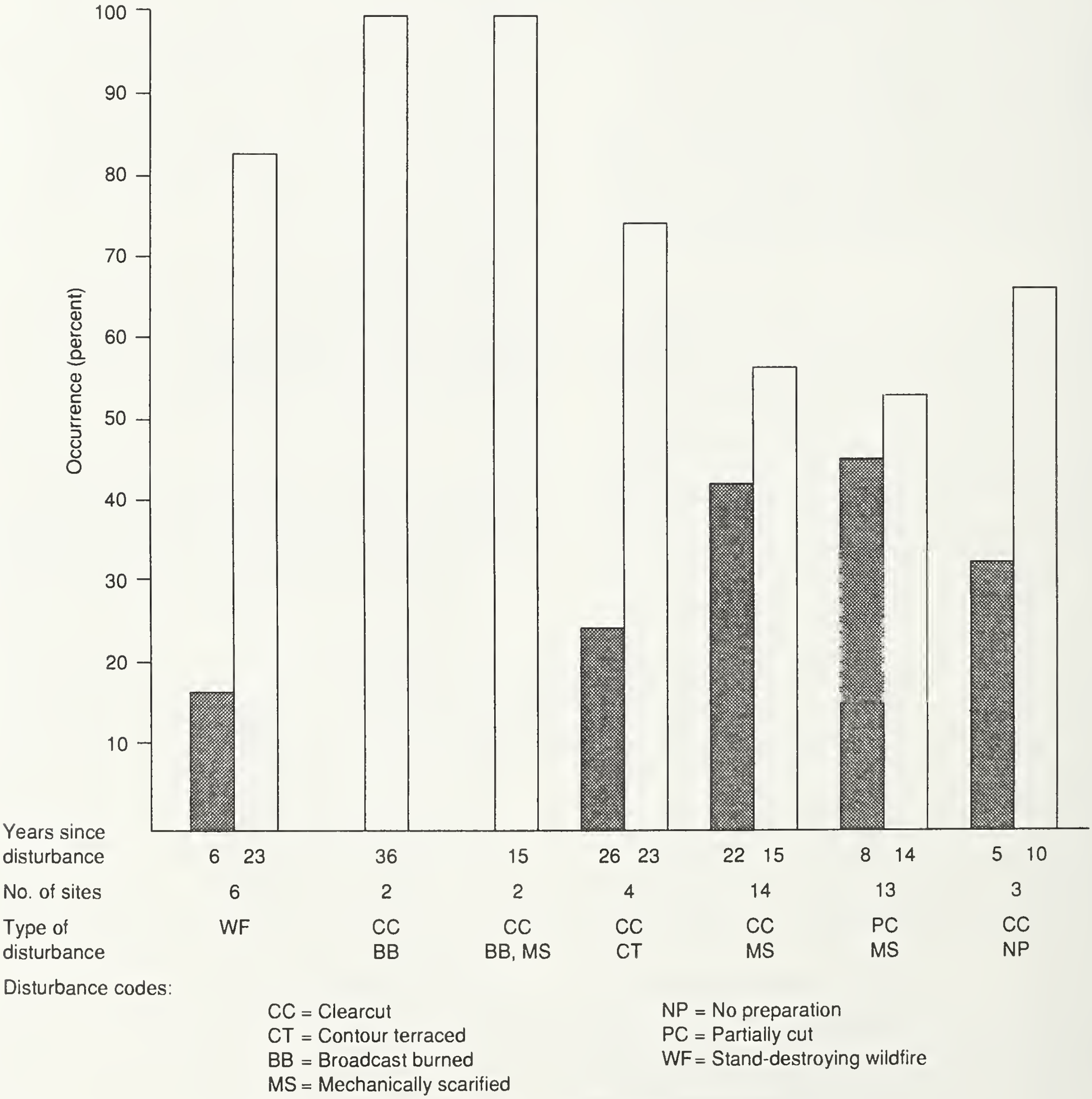

Figure 25—Occurrence of sites with pocket gopher mounds (solid bars) and sites without mounds (hollow bars) following various disturbances in the PSME/CARU h.t., PIPO phase.

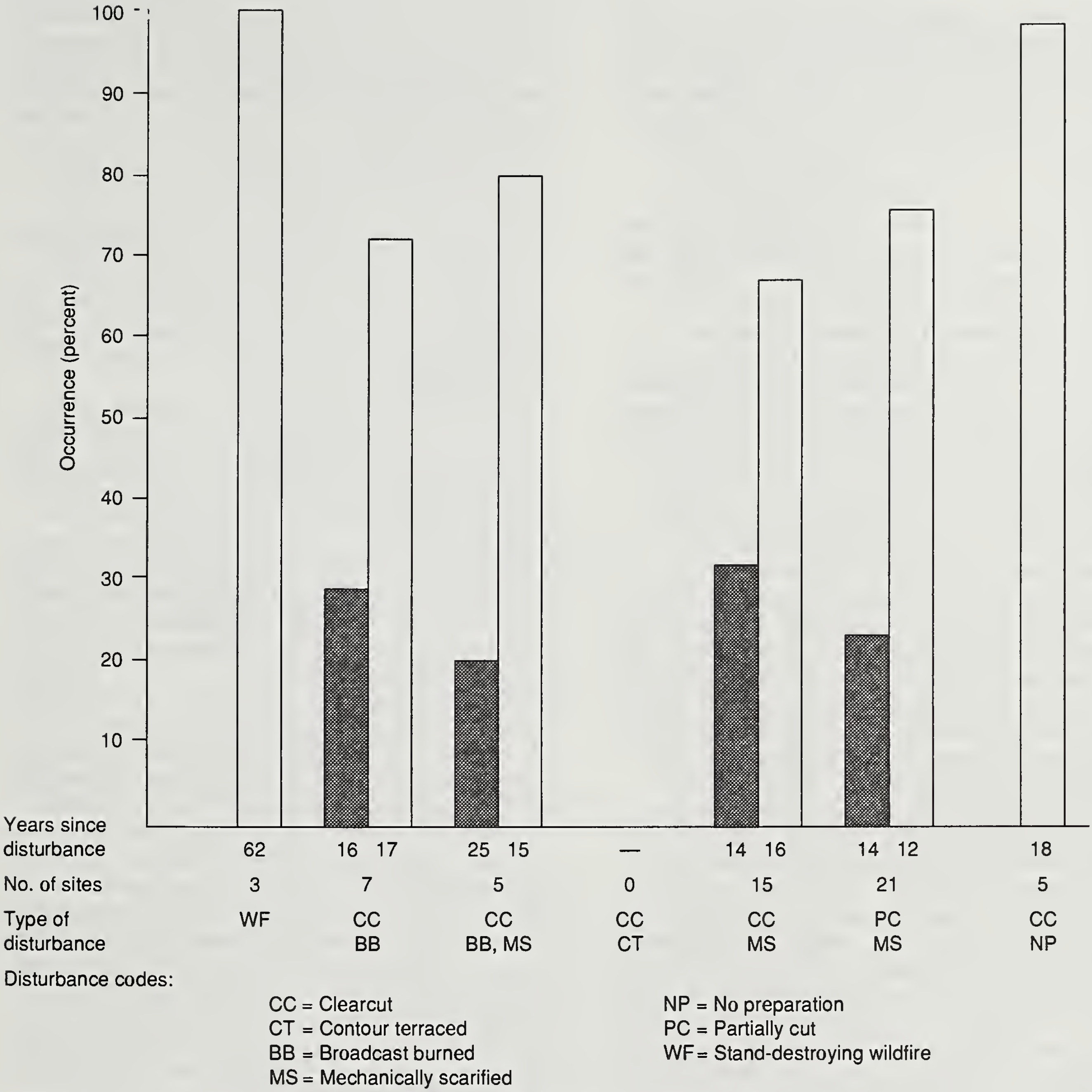

Figure 26—Occurrence of sites with pocket gopher mounds (solid bars) and sites without mounds (hollow bars) following various disturbances in the PSME/CARU h.t., CARU phase.

the herbaceous layer. Fewer seral herb layer species are adapted to these cool sites. Those that are adapted often are as likely to colonize after burning as after scarification.

Snow Damage to Pine Plantations

Snowpack damage to ponderosa pine saplings noted in several other habitat types led us to assess similar damage in PSME/CARU. The damage varied from stripped lateral branches and bent terminals, to 90-degree bends in the main stem, to entire saplings leaning downhill at various angles. Although young pines can recover from much of this damage as described by Oliver (1970), they are often damaged in subsequent years, making total recovery unlikely. These saplings are vulnerable to damage from the time they lose flexibility (about 4.5 ft [1.4 m] in height) until they reach about 4 inches (10.2 cm) d.b.h. This window of vulnerability usually lasts about 13 years, but can last longer if the pines are shaded by tall shrubs or trees. Long-term snow

records indicate that snow damage may occur about every 4 years (Megahan and Steele 1987). The trees often receive repeated damage, causing accumulated deformities. The trees will continue to live unless they are severely damaged or broken but growth rates are reduced (Rehfeldt 1987; Williams 1966), compression wood forms on the downhill side (Panshin and others 1964), and the trees remain vulnerable to shrub competition and repeated snow damage for longer periods. Occasionally at the highest elevations, the bent, stunted trees are killed by the brown-felt blight (*Neopeckia coulteri*) during years of deep snow and prolonged snowmelt.

Recognizing possible snow damage hazards is important where pine plantations are a management objective. A simple technique for predicting snow damage hazards to pine plantations is now available (Megahan and Steele 1988). This approach uses easily measured site characteristics such as slope, aspect, and elevation. It correctly predicts high-hazard sites only about 74 percent of the time. On questionable sites, further consideration may be needed. Sometimes, simple field observations can reveal high snow damage potential. The larger, less flexible stems of tall plants such as *Populus* or *Prunus* may have deformities from past snow damage. Highly flexible plants such as *Ceanothus* or small *Populus* and *Prunus* may show considerable downhill "sweep." In some timber stands the bases of trees may be curved downhill in a "pistol butt" growth form. These characteristics are possible indicators of high snow hazards and should be considered when assessing snow damage potential.

The genetic source of *Pinus ponderosa* seed is also a critical factor. Seed sources can vary widely in snow damage susceptibility and recovery (Rehfeldt and Cox 1975). In general, seedlings from lower elevation seed sources tend to grow faster and sustain more snow damage. Upper elevation seed sources grow more slowly, but the trees recover from snow damage more readily. In some areas, however, upper elevational limits of *P. ponderosa* may be due to deep snowpacks rather than low temperatures. Consequently, at upper elevations where the pine occurs naturally in only minor amounts, even pine plantations from the proper seed source may experience reduced stocking levels. Pines may not be a major component of the stand by rotation age. Selecting seed sources having greater stockiness (Silen and Rowe 1971) may overcome the snow damage problem, but this has yet to be proven.

Competition With Tree Seedlings

Potential competition with tree seedlings is a function of existing vegetation, seed availability, site treatment, and habitat type or phase. The habitat type or phase classifies segments of the environment which determine a species' ability to occupy the site and the magnitude of its potential roles (tables 4, 6). It is not always possible to predict what species will dominate by simply inspecting the site prior to disturbance. Old stands may contain a multitude of early seral species in the form of buried seed (Kramer 1984); other species establish by wind-blown seed. Table 16 lists the major species in PSME/CARU (from climax to early seral), showing which species store seed in the soil, the important methods of seed dissemination, methods of vegetative increase, and germination or vegetative responses to site treatment.

Potential shrub competition for a given site is best estimated by noting the kinds and amounts of shrubs on the site, the other species that may occur from buried or wind-blown seed, and the response of these species to the planned site treatment (table 16). In contrast, generalized descriptions of site treatment and potential shrub responses tend to represent an average stand condition. Such predictions can be misleading for site-specific management, because few stands would fit the average. Many plantations could be lost to unexpected competition.

Duration of the competition depends on height-age interactions of tree seedlings with the shrubs and on shrub density. As noted (table 16), existing and potential shrub densities can be regulated by the kind and intensity of site treatment. These treatments should guard against the possibility of increasing one shrub species while reducing another. Shrub growth rates in PSME/CARU are generalized in figure 27. If free from suppression, properly planted *Pinus ponderosa* can outgrow most shrubs germinating from seed at the time of planting (fig. 28). *Ribes* may substantially overtop the pine within the first few years, but a *Ribes* canopy is usually sparse and does not strongly suppress pine growth. Whenever pines are planted later than one growing season following disturbance, shrub seedlings such as *Ceanothus* or *Salix* may outcompete the pines.

Sprouting ability varies among shrub species and also depends on an individual shrub's size and vigor. Of the major shrubs in PSME/CARU, *Salix* has the greatest sprouting ability. High frequencies of *Salix* in unlogged stands can produce a dense shrub layer if the tree canopy is removed. Planted tree seedlings would be overtopped by the *Salix* sprouts within 2 years. Mechanical removal of *Salix* can entail considerable soil displacement, since these species develop large stumps and deep root systems. Unless the shrubs can be treated with herbicides in such situations, managing for *Pseudotsuga* is the only alternative for timber production.

Table 16—Responses of major shrub and herb layer species to various disturbances in the PSME/CARU h.t.

Species[1]	Seed transport; reproduction methods	Type of disturbance CC NP	SC MS	CC MS	CC BB	WF
Shrubs						
Amelanchier alnifolia	Birds, mammals; not stored in soil. Germinates mainly on mineral soil in partial shade.	v	v-s	v	v	v-s
Symphoricarpos oreophilus	Birds, mammals; not stored in soil. Germinates mainly on mineral soil in partial shade.	v	v-s	v	v	v-s
Prunus spp.	Birds, mammals; stored in soil (27 percent viable)[2]. Germinates in full sun following scarification or burning. Increases by root-sprouts.	V	v	V-s	V-s	V-s
Salix scouleriana	Wind; not stored in soil. Germinates on moist mineral soil in full sun following scarification or burning. Stumps resprout vigorously.	V	v	V-s	V-s	V-s
Ribes spp.	Birds, mammals; stored in soil (96 percent viable). Germinates on mineral soil in full sun, mainly following scarification.	n	d	d-S	s	s
Ceanothus velutinus	No obvious transport; seed stored in soil (91 percent viable). Germinates on mineral soil in full sun, mainly following burning.	n	d	d-s	S	S
Purshia tridentata	Rodents; not stored in soil. Germinates on mineral soil in full sun, mainly following scarification.	n	D	D-S	D-s	D-s
Artemisia tridentata	Wind; not stored in soil. Germinates on mineral soil in full sun following burning or scarification.	n	D	D-S	D-S	D-S
Chrysothamnus spp.	Wind; not stored in soil. Germinates on mineral soil in full sun following burning or scarification.	n	D	D-S	D-S	D-S
Perennial graminoids						
Calamagrostis rubescens	Wind; not stored in soil, germinates on mineral soil. Increases by rhizomes.	V	d	d	V	V-s
Poa nervosa	Wind; not stored in soil. Germinates on mineral soil. Increases by rhizomes.	V	d	d	V-s	V-s
Carex geyeri	No obvious transport; stores in soil (56 percent viable). Germinates on mineral soil following burning or scarification. Increases by short rhizomes.	n	d-S	d-S	n-s	n-s
Carex rossii	No obvious transport; stores in soil (57 percent viable). Germinates on mineral soil, mainly following scarification in full sun.	n	d-s	d-S	s	s

(con.)

Table 16 (Con.)

Species[1]	Seed transport; reproduction methods	Type of disturbance CC NP	SC MS	CC MS	CC BB	WF
Bromus inermis	Wind (usually direct seeding); not stored in soil. Germinates on mineral soil in full sun. Increases by rhizomes.	V	D	D-s	V-s	V-s
Bromus carinatus	Wind; not stored in soil. Germinates on mineral soil in full sun.	v	D	D-s	v-s	v-s
Perennial herbs						
Antennaria racemosa	Wind; not stored in soil. Germinates on mineral soil in partial shade. Increases by stolons.	d	D-s	D	D	D
Arnica cordifolia	Wind; not stored in soil. Germinates on mineral soil in partial shade. Increases by rhizomes.	n	D-s	D	n	n-s
Aster conspicuus	Wind; not stored in soil. Germinates on mineral soil in partial shade. Increases by rhizomes.	v	d-s	d	V	V-s
Lupinus spp.	No obvious transport; stored in soil (100 percent viable). Germinates on mineral soil in full sun or partial shade.	v	d-s	d-s	v-s	v-s
Fragaria spp.	Birds, mammals; stored in soil (23 percent viable). Germinates on moist mineral soil in partial shade. Increases by stolons.	V	D-s	D	d	d-s
Apocynum androsaemifolium	Wind; not stored in soil. Germination requirements unknown. Increases by rhizomes.	V	v	V	V	V
Veratrum californicum	Possibly wind; storage ability unknown. Germination requirements unknown. Increases by rhizomes.	v	d	d-s	v-s	v-s
Antennaria microphylla	Wind; not stored in soil. Germinates on mineral soil, mainly following scarification.	v	D	D-s	d	d
Epilobium angustifolium	Wind; not stored in soil. Germinates on moist mineral soil in full sun or partial shade. Increases by rhizomes.	V	d-s	d-s	V-S	V-S
Penstemon attenuatus	No obvious transport; some storage in soil. Germinates on mineral soil in full sun.	n	D	D-S	D-s	D-s
Geranium viscosissimum	No obvious transport; stores in soil (90 percent viable). Germinates on mineral soil in full sun.	n	d	d-S	n-s	n-s
Iliamna rivularis	No obvious transport; stores in soil (91 percent viable). Germinates on mineral soil in full sun, mainly following burning.	n	D	D-s	S	S

(con.)

Table 16 (Con.)

Species[1]	Seed transport; reproduction methods	Type of disturbance CC NP	SC MS	CC MS	CC BB	WF
Potentilla glandulosa	No obvious transport; stores in soil (19 percent viable). Germinates on mineral soil in full sun, mainly following scarification.	n	D-s	D-s	s	s

DISTURBANCE CODES:
CC, NP = Clearcut, no site preparation.
SC, MS = Shelterwood cut, mechanical scarification.
CC, MS = Clearcut, mechanical scarification.
CC, BB = Clearcut, broadcast burned.
WF = Stand-destroying wildfire.

RESPONSE CODES:
V = Vegetative increase from existing plants following tree removal (may be offset by treatment intensity).
S = Seedling response (coverage increase depends on amount of viable seed available and may be influenced by treatment type and intensity).
D = Decrease in existing canopy coverage.
n = No appreciable change.
Upper Case Letters = Major change worthy of management consideration.
Lower Case Letters = Minor change in species coverage.

[1]Species are arranged from climax to seral within each group.
[2]Stored seed viabilities are from Kramer (1984).

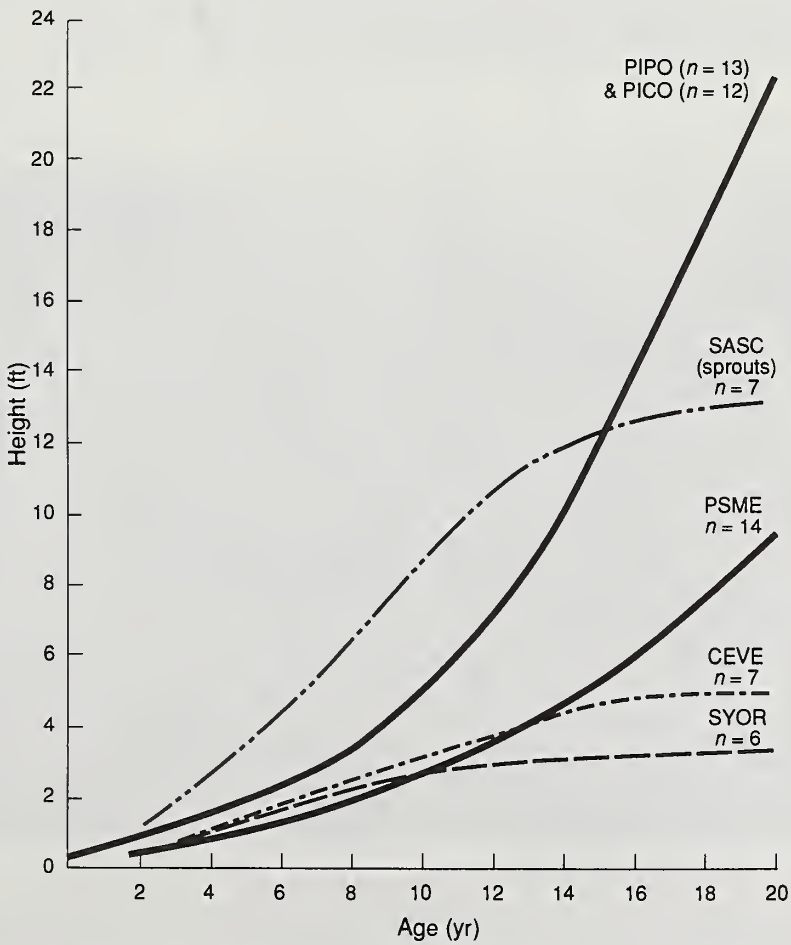

Figure 27—Height-age relationships of free-growing tree seedlings and some important shrub species in the PSME/CARU h.t.

Figure 28a—A PSME/CARU site in 1983 about 3 years after a stand-destroying wildfire. Annuals and biennials dominate the site. *Ceanothus* has germinated from buried seed but is not yet evident. *Pinus ponderosa* and *Pseudotsuga* were quite low. Trace amounts of *Bromus inermis*, apparently from artificial seeding, are also present.

Figure 28b—Same site in 1989. Most of the fire-killed trees have fallen, and the planted pines are quite evident. *Ceanothus* dominates the shrub layer. Annuals and biennials are present only in trace amounts. *Bromus inermis* is now well represented in the herb layer.

Big Game and Livestock

The classification sections describe some layer groups that can be achieved through prescribed site treatments and others that result mainly from uninterrupted succession. The actual layer type that may result from a particular site treatment can often be projected on a stand-by-stand basis from species composition and successional response. When land managers consider the possible shrub layer types that can result from alternative site treatments, they may also wish to consider the relative forage value of these layer types for big game and livestock. Such values can be estimated from relative palatability ratings of plant species for elk (Kufeld 1973), deer (Kufeld and others 1973), cattle and sheep (USDA Forest Service 1986), and black bear (Beecham 1981). The scale of 1 to 3 in these studies was expanded to 1 to 6 to emphasize the differences in palatability values. The relative palatability value for each plant species is listed in appendixes A and B. This value was multiplied by the percentage constancy and average canopy cover (appendixes A, B) in a given layer type. The sum of all such products within a layer type resulted in a forage index value for that particular type. The index values were reduced to classes to simplify forage value assessments and to eliminate the false impression of high precision (table 17).

These index classes reflect forage potential on a relative basis. They do not necessarily reflect actual use, which is affected by the surrounding vegetation types. Some index values may be biased by consistent disproportions of canopy cover to shrub volume. Likewise, actual palatability within a species can vary with plant vigor; however, other sources of variation common to this type of comparison have been reduced. For instance, the possibility of ecotypes (ecological variants within a plant species) is reduced by restricting the data to one habitat type. Individual animals

Table 17—Index classes to big-game and livestock forage preferences by shrub layer types in the PSME/CARU h.t., PIPO phase[1]

Layer group	No. of	Deer		Elk		Cattle	Sheep	Black bear		
Layer type	stands	SU[2]	W	SU	W	SU	SU	SP	SU	F
Purshia tridentata										
PUTR-CEVE	1	[3]2	2	1	2	1	1	0	0	0
PUTR-SASC	1	2	1	0	2	1	2	0	0	0
PUTR-SYOR	1	3	2	2	1	1	2	1	1	1
PUTR-CARU	6	1	1	0	1	1	1	0	0	0
Ceanothus velutinus										
CEVE-CEVE	8	3	2	3	2	1	1	0	0	0
CEVE-SASC	6	3	1	1	2	1	1	0	0	0
CEVE-PRVI	2	4	2	5	2	2	2	1	2	3
CEVE-SYOR	2	2	1	2	1	1	1	0	1	1
CEVE-CARU	4	1	1	1	1	0	1	0	0	0
Ribes cereum										
RICE-RICE	2	0	0	0	0	0	0	0	1	1
RICE-SYOR	2	1	1	2	0	1	1	1	1	1
RICE-CARU	2	0	0	0	0	0	0	1	1	1
Salix scouleriana										
SASC-SASC	2	2	0	0	1	1	1	0	0	0
SASC-CARU	3	2	0	0	1	1	1	0	0	0
Prunus virginiana										
PRVI-PRVI	1	2	2	2	3	1	1	1	2	3
PRVI-SYOR	1	2	2	2	1	1	2	1	1	2
PRVI-CARU	2	2	1	2	2	1	1	1	2	3
Symphoricarpos oreophilus										
SYOR-SYOR	2	1	1	1	1	1	1	1	1	1
SYOR-CARU	2	1	1	1	1	0	1	0	1	1

[1]Based on palatability ratings by Kufeld (1973), Kufeld and others (1973), USDA FS (1986), and Beecham (1981).
[2]SP = spring (March, April, May); SU = summer (June, July, August); F = fall (September, October, November); W = winter (December, January, February).
[3]Code to index classes:

0 = 0-50	1 = 51-150	2 = 151-250 (low)
3 = 251-350	4 = 351-450	5 = 451-550 (moderate)
6 = 551-650	7 = 651-750	8 = 751-850 (high)

may have slightly different forage preferences, but all layer types can be made available to the same group of animals. Plant species palatabilities are listed by season to accommodate seasonal forage preferences. In spite of the shortcomings inherent with these comparisons, the forage index classes can provide general guidelines to relative browse potential for specific wildlife and range objectives as well as multiple-use planning. Range and wildlife managers who may have better species palatability ratings for a local area can easily recalculate the forage indexes from the appendixes, reduce the indexes to index classes (tables 17, 18, 19, 20), and apply the results to their area.

Forage index classes vary according to the kinds and amounts of plant species comprising the layer type. Because early seral layer types may contain a wider variety of plants than later stages, a larger data base is often needed to reflect forage indexes in these early stages. When the same layer type occurs in different habitat types or phases, more samples may be needed for the more productive sites. Coverages of the most palatable species have the greatest effect on the index value. It does not necessarily increase with site productivity, although this is often the case. Index values could be refined by ranking species' nutritional value between habitat types and phases. Such considerations should be used when comparing relative significance of forage index classes. When both shrub and herb layer types are known for a given site, the index values can be added to give a total forage index for that site.

Deer—Shrub layer forage values for deer are mostly low to moderate throughout PSME/CARU succession. In the PIPO phase, the highest index class for deer occurred in the CEVE-PRVI layer type (table 17). CEVE-PRVI is most easily achieved by clearcutting stands that contain residual *Prunus*, followed by broadcast burning. In the CARU phase the highest forage index for deer occurred in the CEVE-CEVE layer type (table 18). This layer type ranked high for deer due to exceptionally high coverages of *Ceanothus*. These stands had experienced high-intensity burns 19 to 38 years ago.

Herb layer forage values for deer in summer are low to moderate throughout PSME/CARU succession (tables 19, 20). The highest values tend to occur in the PIPO phase rather than the CARU phase. The higher values reflect the warmer conditions in the PIPO phase, which create greater forb production.

In winter, herb layer forage values remain low to moderate but some are higher than the corresponding summer values, especially in the CARU phase. This is due to high coverages of *Calamagrostis* occurring in some layer types. The *Calamagrostis* has higher forage value for deer in winter than in summer (appendix B).

Elk—Shrub forage values for elk are also low to moderate (tables 17, 18). In the PIPO phase, the

Table 18—Index classes to big-game and livestock forage preferences by shrub layer type in the PSME/CARU h.t., CARU phase[1]

Layer group Layer type	No. of stands	Deer		Elk		Cattle	Sheep	Black bear		
		SU[2]	W	SU	W	SU	SU	SP	SU	F
Artemisia tridentata										
ARTR-RICE	1	[3]1	2	2	2	1	1	1	2	1
ARTR-CEVE	2	3	3	3	3	2	2	1	1	1
ARTR-CARU	4	1	2	1	1	1	1	0	0	0
Ceanothus velutinus										
CEVE-CEVE	4	6	3	5	5	2	2	0	0	0
CEVE-RICE	2	2	2	2	2	1	1	1	2	1
CEVE-CARU	2	3	2	3	2	1	1	0	0	0
Ribes cereum										
RICE-RICE	5	1	1	1	0	1	1	1	2	2
RICE-SYOR	5	1	1	1	0	1	1	1	1	1
RICE-CARU	4	0	0	0	0	0	1	0	1	1
Symphoricarpos oreophilus										
SYOR-SYOR	1	2	1	2	0	1	1	1	1	1
SYOR-CARU	8	1	1	1	0	0	1	0	1	1

[1]Based on palatability ratings by Kufeld (1973), Kufeld and others (1973), USDA FS (1986), and Beecham (1981).
[2]SP = spring (March, April, May); SU = summer (June, July, August); F = fall (September, October, November); W = winter (December, January, February).
[3]Code to index classes:

0 = 0-50	1 = 51-150	2 = 151-250 (low)
3 = 251-350	4 = 351-450	5 = 451-550 (moderate)
6 = 551-650	7 = 651-750	8 = 751-850 (high)

Table 19—Index classes to big-game and livestock forage preferences by herb layer type in the PSME/CARU h.t., PIPO phase[1]

Layer group / Layer type	No. of stands	Deer SU[2]	Deer W	Elk SU	Elk W	Cattle SU	Sheep SU	Black bear SP	Black bear SU	Black bear F
Annuals										
ANN.-ANN.	1	[3]1	1	2	1	2	2	0	0	0
ANN.-CARO	2	1	1	2	1	2	2	2	1	1
ANN.-CAGE	1	1	1	1	1	1	1	1	1	0
ANN.-CARU	2	2	2	3	2	2	2	2	1	1
Bromus carinatus										
BRCA-POGL	1	2	1	2	1	2	2	0	0	0
BRCA-CAGE	1	2	2	4	3	4	3	2	1	1
Potentilla glandulosa										
POGL-POGL	1	3	2	4	2	3	4	1	1	0
POGL-GEVI	2	2	1	3	2	2	2	1	1	0
POGL-APAN	2	2	1	2	2	2	2	1	1	0
POGL-FRVE	1	5	4	6	6	6	6	4	4	2
POGL-CAGE	3	2	2	3	2	3	2	2	1	1
Geranium viscosissimum										
GEVI-EPAN	1	4	3	6	3	3	4	2	1	1
GEVI-CAGE	3	3	3	5	4	4	4	3	2	1
GEVI-CARU	5	2	2	4	2	3	3	2	2	1
Epilobium angustifolium										
EPAN-CARU	2	2	2	4	2	4	3	3	2	1
Apocynum androsaemifolium										
APAN-CAGE	1	3	2	4	3	3	3	2	2	1
APAN-CARU	3	3	2	4	2	4	4	2	2	1
Fragaria vesca										
FRVE-FRVE	1	1	1	1	2	1	2	1	2	1
FREV-CARU	2	1	2	2	2	2	2	2	2	1
Lupinus spp.										
LUP.-CAGE	1	4	4	7	6	7	5	6	4	2
LUP.-CARU	2	4	2	5	3	4	4	2	2	1
Carex geyeri										
CAGE-CAGE	4	2	2	2	2	2	2	2	2	1
CAGE-CARU	14	2	2	3	2	3	2	2	2	1
Calamagrostis rubescens										
CARU-CARU	9	1	2	3	2	2	2	2	1	1

[1]Based on palatability ratings by Kufeld (1973), Kufeld and others (1973), USDA FS (1986), and Beecham (1981).
[2]SP = spring (March, April, May); SU = summer (June, July, August); F = fall (September, October, November); W = winter (December, January, February).
[3]Code to index classes: 0 = 0-50; 1 = 51-150; 2 = 151-250 (low); 3 = 251-350; 4 = 351-450; 5 = 451-550 (moderate); 6 = 551-650; 7 = 651-750; 8 = 751-850 (high)

CEVE-PRVI layer type has the highest forage index for elk during the summer. In the CARU phase, the CEVE-CEVE layer type ranked highest for elk forage. These layer types also ranked highest for deer, which suggests that deer and elk may be competing for the same shrubs in PSME/CARU. However, forage demands may differ when the herb layer is considered.

Herb layer forage values for elk are mostly low to moderate in summer (tables 19, 20). However, some high values occur in the POGL, GEVI, and LUP. layer groups of the PIPO phase. These higher values were due mainly to high coverages of *Epilobium angustifolium* or *Carex geyeri*, both of which have high palatability. In the CARU phase, high values occur in the GEVI and EPAN layer groups. In these instances high coverages of *Calamagrostis* resulted in the high forage indexes.

Forage values are generally lower in winter, but remain high in the POGL-FRVE and LUP.-CAGE layer types (table 19). These high values are due to high coverages of *Fragaria* and *Carex geyeri,* which have high palatability in winter.

Table 20—Index classes to big-game and livestock forage preferences by herb layer type in the PSME/CARU h.t., CARU phase[1]

Layer group / Layer type	No. of stands	Deer SU[2]	Deer W	Elk SU	Elk W	Cattle SU	Sheep SU	Black bear SP	Black bear SU	Black bear F
Annuals										
ANN.-POGL	1	[3]2	1	3	1	2	2	0	0	0
ANN.-EPAN	1	2	1	3	2	2	2	1	1	0
ANN.-CARU	2	2	2	4	3	4	3	4	2	1
Bromus carinatus										
BRCA-GEVI	1	2	1	2	1	2	2	0	0	0
BRCA-FRVE	1	2	1	2	1	2	2	1	1	0
BRCA-CAGE	2	3	2	5	4	4	3	3	2	1
BRCA-CARU	4	2	2	4	3	4	3	3	2	1
Potentilla glandulosa										
POGL-CARO	1	1	1	1	1	1	1	1	1	0
POGL-EPAN	1	2	1	3	1	1	2	0	0	0
POGL-CAGE	3	3	3	5	4	5	4	5	3	2
POGL-CARU	6	2	3	5	3	4	4	4	3	1
Geranium viscosissimum										
GEVI-LUP.	1	3	2	4	2	2	4	1	1	0
GEVI-CAGE	2	3	2	4	3	4	3	3	2	1
GEVI-CARU	1	3	5	7	5	7	5	6	4	2
Epilobium angustifolium										
EPAN-CARU	2	3	4	6	4	6	5	5	4	2
Antennaria microphylla										
ANMI-CARU	3	2	2	3	2	3	3	2	2	1
Fragaria vesca										
FRVE-CARU	2	1	1	3	2	2	2	2	1	1
Lupinus spp.										
LUP.-CAGE	2	2	2	4	3	3	3	2	1	1
LUP.-CARU	7	3	3	5	3	5	4	3	2	1
Carex geyeri										
CAGE-CAGE	6	2	2	3	3	3	2	3	2	1
CAGE-CARU	12	2	3	5	4	5	4	4	3	1
Calamagrostis rubescens										
CARU-CARU	25	2	3	5	3	5	4	4	3	1

[1]Based on palatability ratings by Kufeld (1973), Kufeld and others (1973), USDA FS (1986), and Beecham (1981).
[2]SP = spring (March, April, May); SU = summer (June, July, August); F = fall (September, October, November); W = winter (December, January, February).
[3]Code to index classes: 0 = 0-50; 1 = 51-150; 2 = 151-250 (low); 3 = 251-350; 4 = 351-450; 5 = 451-550 (moderate); 6 = 551-650; 7 = 651-750; 8 = 751-850 (high)

Cattle—Shrub layer forage values are consistently low for cattle throughout PSME/CARU (tables 17, 18). However, cattle may be attracted to these sites by the herb layer forage and the shelter provided by standing timber.

Herb layer values for cattle are mostly low to moderate, but a few layer types rank high (tables 19, 20). These high-value layer types (and many of the moderate ones) have identical rankings with those for summer elk. This suggests cattle and elk may compete for summer forage in the herb layer. No herb layer type ranked higher for cattle than for elk.

The PSME/CARU h.t., particularly in the CARU phase, often borders rangeland and is a common resting area for cattle. Conflicts may arise between cattle use and tree regeneration. Encouraging shrub layer development through burning or scarification would provide microsites for Douglas-fir seedlings and protect them from cattle.

Sheep—Shrub layer forage values for sheep are low throughout PSME/CARU but may be slightly higher for sheep than for cattle in some layer types (tables 17, 18).

Forage values in the herb layer are generally low to moderate (tables 19, 20). Most herb layer types have an equal or higher ranking for either deer or elk in the summer. Forage values do not differ much between sheep and cattle. This suggests that sheep, cattle, and elk may compete for summer forage in the herb layer.

Sheep herds that use PSME/CARU generally move through these sites rather quickly due to the sparse shrub layer and low forage values. As a result, their impact on the site is generally light. The larger bands break up the pinegrass sod, creating seedbeds for tree seedlings. Once tree seedlings have established, alternate travel routes are needed to ensure seedling survival. Rotating travel routes can treat many areas by creating seedbeds.

Black Bear—Most shrub layers in PSME/CARU provide little or no forage value for bears (tables 17, 18). Exceptions are those layer types where *Prunus* is well represented. CEVE-PRVI, PRVI-PRVI, and PRVI-CARU are usually the layer types involved. Full sunlight is needed to produce ample *Prunus* fruit. If sparse, the *Prunus* cover may be increased by burning to topkill decadent clones and encourage rootsprouting. It is likely that burning also promotes *Prunus* establishment from seed. *Symphoricarpos* and *Amelanchier* may also add to some forage values, especially in the PRVI-SYOR layer type. These shrubs should also respond favorably to burning. They produce ample fruit in full sunlight.

Herb layer values for black bear are mostly low to moderate in the spring, becoming progressively lower through summer and into fall. Most of the moderate forage values in spring (tables 19, 20) are due to high coverages of *Carex* and *Calamagrostis*. These and other coarse graminoids are sought during spring greenup as the bears emerge from hibernation. Otherwise, PSME/CARU herb layers have little forage value for bears.

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APPENDIX A-1: PALATABILITY RATINGS, CONSTANCY,[1] AND AVERAGE CANOPY COVER (PERCENT) OF SHRUBS BY LAYER TYPE IN THE PSME/CARU H.T., PIPO PHASE

SHRUB LAYER GROUP

Shrub layer type

Number of stands

Code No.	Palatability ratings[2] Shrub species	Deer Summer	Deer Winter	Elk Summer	Elk Winter	Cattle Summer	Sheep Summer	Black Bear Spring	Black Bear Summer	Black Bear Fall
102	*Acer glabrum*	4	6	6	6	4	4	0	0	0
105	*Amelanchier alnifolia*	4	4	6	6	3	5	2	6	6
201	*Arctostaphylos uva-ursi*	0	0	0	0	0	0	2	4	6
150	*Artemisia tridentata*	2	4	2	4	2	2	0	0	0
203	*Berberis repens*	2	4	2	4	2	3	2	4	4
107	*Ceanothus velutinus*	6	4	6	6	2	2	0	0	0
108	*Chrysothamnus nauseosus*	2	4	0	4	2	2	0	0	0
152	*Chrysothamnus viscidiflorus*	2	4	2	2	2	2	0	0	0
115	*Lonicera utahensis*	2	4	6	4	2	2	2	4	4
123	*Prunus emarginata*	4	0	6	0	2	2	2	4	6
124	*Prunus virginiana*	4	4	4	6	2.5	3	2	4	6
125	*Purshia tridentata*	6	6	0	6	4	6	0	0	0
128	*Ribes cereum*	0	2	2	0	2	2.5	2	6	4
131	*Ribes viscosissimum*	0	0	6	0	2	3	2	6	4
161	*Rosa nutkana*	6	4	6	4	2	4	0	0	0
137	*Salix scouleriana*	6	0	0	4	2	3	0	0	0
164	*Sambucus cerulea*	6	2	6	0	3	4	2	2	2
139	*Shepherdia canadensis*	2	2	2	4	2	4	2	6	4
140	*Sorbus scopulina*	6	0	6	4	0	0	2	2	6
142	*Spiraea betulifolia*	4	2	0	4	2	3	0	0	0
143	*Symphoricarpos albus*	4	2	6	6	2	4	2	2	2
163	*Symphoricarpos oreophilus*	4	3	4	0	2	3	2	2	2
145	*Vaccinium caespitosum*	0	0	0	0	0	0	0	0	0
307	*Calamagrostis rubescens*	—	—	—	—	—	—	—	—	—

Years since disturbance - average:
- range:

[1]Code to constancy values: + = 0-5%, 1 = >5-15%, 2 = >15-25%, 3 = >25-35%, 4 = >35-45%, 5 = >45-55%, 6 = >55-65%, 7 = >65-75%, 8 = >75-85%, 9 = >85-95%, 10 = >95-100%

[2]Based on palatability ratings by Kufeld and others (1973), Kufeld (1973), USDA FS (1986), and Beecham (1981).

(con.)

APPENDIX A-1 (Con.)

SHRUB LAYER GROUP		Purshia tridentata				Ceanothus velutinus				
Shrub layer type		PUTR -CEVE	PUTR -SASC	PUTR -SYOR	PUTR -CARU	CEVE -CEVE	CEVE -SASC	CEVE -PRVI	CEVE -SYOR	CEVE -CARU
Number of stands		*n* = 1	*n* = 1	*n* = 1	*n* = 6	*n* = 8	*n* = 6	*n* = 2	*n* = 2	*n* = 4
Code No.	Shrub species									
102	*Acer glabrum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
105	*Amelanchier alnifolia*	0(0.0)	10(3.0)	10(3.0)	7(1.8)	4(1.3)	7(0.5)	10(7.8)	10(1.8)	8(2.2)
201	*Arctostaphylos uva-ursi*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
150	*Artemisia tridentata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	4(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
203	*Berberis repens*	0(0.0)	10(0.5)	10(0.5)	3(0.5)	3(0.5)	3(0.5)	5(0.5)	10(0.5)	3(0.5)
107	*Ceanothus velutinus*	10(15.0)	0(0.0)	0(0.0)	2(0.5)	10(37.8)	10(15.0)	10(26.3)	10(15.0)	10(15.0)
108	*Chrysothamnus nauseosus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)
152	*Chrysothamnus viscidiflorus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
115	*Lonicera utahensis*	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	2(15.0)	0(0.0)	0(0.0)	0(0.0)
123	*Prunus emarginata*	0(0.0)	0(0.0)	0(0.0)	2(3.0)	3(1.8)	2(0.5)	10(38.8)	10(0.5)	0(0.0)
124	*Prunus virginiana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)	0(0.0)	5(0.5)	5(3.0)	3(3.0)
125	*Purshia tridentata*	10(15.0)	10(15.0)	10(15.0)	10(18.8)	3(0.5)	7(0.5)	10(0.5)	5(0.5)	5(1.8)
128	*Ribes cereum*	10(0.5)	10(3.0)	10(0.5)	2(3.0)	6(1.5)	7(1.1)	5(3.0)	5(3.0)	3(0.5)
131	*Ribes viscosissimum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	2(0.5)	0(0.0)	5(0.5)	3(0.5)
161	*Rosa nutkana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	3(0.5)
137	*Salix scouleriana*	10(0.5)	10(15.0)	0(0.0)	3(1.8)	10(3.3)	10(34.6)	5(3.0)	5(3.0)	10(1.8)
164	*Sambucus cerulea*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	5(3.0)	3(0.5)
139	*Shepherdia canadensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
140	*Sorbus scopulina*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	0(0.0)	5(0.5)	3(0.5)
142	*Spiraea betulifolia*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	5(0.5)	3(3.0)	0(0.0)	0(0.0)	0(0.0)
143	*Symphoricarpos albus*	0(0.0)	0(0.0)	0(0.0)	2(3.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	3(0.5)
163	*Symphoricarpos oreophilus*	10(0.5)	10(0.5)	10(37.5)	2(0.5)	9(5.0)	3(0.5)	10(7.8)	10(15.0)	8(1.3)
145	*Vaccinium caespitosum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	3(0.5)
307	*Calamagrostis rubescens*	10(15.0)	10(3.0)	10(15.0)	10(26.3)	9(11.6)	10(22.9)	10(3.0)	10(9.0)	10(26.3)
Years since disturbance - average:		16	11	50	21	14	29	32	14	20
- range:		16	11	50	7-52	3-25	6-50	26-38	12-17	6-55

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

(con.)

APPENDIX A-1 (Con.)

SHRUB LAYER GROUP		*Ribes cereum*			*Salix scouleriana*		*Prunus virginiana*			*Symphoricarpos oreophilus*	
Shrub layer type		RICE -RICE	RICE -SYOR	RICE -CARU	SASC -SASC	SASC -CARU	PRVI -PRVI	PRVI -SYOR	PRVI -CARU	SYOR -SYOR	SYOR -CARU
Number of stands		*n* = 2	*n* = 2	*n* = 2	*n* = 2	*n* = 3	*n* = 1	*n* = 1	*n* = 2	*n* = 2	*n* = 2
Code No.	Shrub species										
102	*Acer glabrum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)
105	*Amelanchier alnifolia*	5(0.5)	0(0.0)	0(0.0)	5(0.5)	10(1.3)	10(3.0)	10(0.5)	5(15.0)	10(7.8)	10(7.8)
201	*Arctostaphylos uva-ursi*	0(0.0)	0(0.0)	5(15.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
150	*Artemisia tridentata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(0.5)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)
203	*Berberis repens*	0(0.0)	0(0.0)	5(0.5)	5(3.0)	3(0.5)	10(0.5)	10(0.5)	5(0.5)	5(3.0)	5(0.5)
107	*Ceanothus velutinus*	10(0.5)	5(3.0)	0(0.0)	10(3.0)	7(3.0)	10(0.5)	0(0.0)	0(0.0)	5(3.0)	0(0.0)
108	*Chrysothamnus nauseosus*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
152	*Chrysothamnus viscidiflorus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
115	*Lonicera utahensis*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)
123	*Prunus emarginata*	0(0.0)	5(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(15.0)	5(0.5)	0(0.0)
124	*Prunus virginiana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(37.5)	10(15.0)	10(26.3)	5(3.0)	5(0.5)
125	*Purshia tridentata*	0(0.0)	0(0.0)	0(0.0)	10(3.0)	10(0.5)	0(0.0)	10(3.0)	0(0.0)	0(0.0)	0(0.0)
128	*Ribes cereum*	10(15.0)	10(15.0)	10(15.0)	10(3.0)	3(0.5)	0(0.0)	0(0.0)	5(0.5)	5(3.0)	10(1.8)
131	*Ribes viscosissimum*	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	5(0.5)	0(0.0)
161	*Rosa nutkana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	10(0.5)	5(0.5)	0(0.0)	0(0.0)
137	*Salix scouleriana*	5(0.5)	0(0.0)	0(0.0)	10(26.3)	10(22.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(3.0)
164	*Sambucus cerulea*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
139	*Shepherdia canadensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
140	*Sorbus scopulina*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(3.0)	0(0.0)
142	*Spiraea betulifolia*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	5(3.0)	0(0.0)	0(0.0)
143	*Symphoricarpos albus*	0(0.0)	0(0.0)	10(3.0)	0(0.0)	3(0.5)	10(0.5)	0(0.0)	10(0.5)	0(0.0)	0(0.0)
163	*Symphoricarpos oreophilus*	10(1.8)	10(26.3)	0(0.0)	0(0.0)	10(1.3)	10(3.0)	10(37.5)	5(3.0)	10(15.0)	10(9.0)
145	*Vaccinium caespitosum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
307	*Calamagrostis rubescens*	10(1.8)	5(3.0)	10(37.5)	10(3.0)	10(45.8)	10(15.0)	10(15.0)	10(50.0)	10(1.8)	10(15.0)
Years since disturbance - average:		12	22	14	18	31	6	75	80	17	56
- range:		12	22	14	17-19	22-51	6	75	75-85	10-24	11-100

[1]Code to constancy values: + = 0-5%, 1 = >5-15%, 2 = >15-25%, 3 = >25-35%, 4 = >35-45%, 5 = >45-55%, 6 = >55-65%, = >65-75%, 8 = >75-85%, 9 = >85-95%, 10 = >95-100%

APPENDIX A-2: PALATABILITY RATINGS, CONSTANCY,[1] AND AVERAGE CANOPY COVER (PERCENT) OF SHRUBS BY LAYER TYPE IN THE PSME/CARU H.T., CARU PHASE

SHRUB LAYER GROUP

Shrub layer type

Number of stands

Code No.	Palatability ratings[2] Shrub species	Deer Summer	Deer Winter	Elk Summer	Elk Winter	Cattle Summer	Sheep Summer	Black Bear Spring	Black Bear Summer	Black Bear Fall
102	*Acer glabrum*	4	6	6	6	4	4	0	0	0
105	*Amelanchier alnifolia*	4	4	6	6	3	5	2	6	6
201	*Arctostaphylos uva-ursi*	0	0	0	0	0	0	2	4	6
150	*Artemisia tridentata*	2	4	2	4	2	2	0	0	0
203	*Berberis repens*	2	4	2	4	2	3	2	4	4
107	*Ceanothus velutinus*	6	4	6	6	2	2	0	0	0
108	*Chrysothamnus nauseosus*	2	4	0	4	2	2	0	0	0
152	*Chrysothamnus viscidiflorus*	2	4	2	2	2	2	0	0	0
115	*Lonicera utahensis*	2	4	6	4	2	2	2	4	4
123	*Prunus emarginata*	4	0	6	0	2	2	2	4	6
124	*Prunus virginiana*	4	4	4	6	2.5	3	2	4	6
125	*Purshia tridentata*	6	6	0	6	4	6	0	0	0
128	*Ribes cereum*	0	2	2	0	2	2.5	2	6	4
131	*Ribes viscosissimum*	0	0	6	0	2	3	2	6	4
161	*Rosa nutkana*	6	4	6	4	2	4	0	0	0
137	*Salix scouleriana*	6	0	0	4	2	3	0	0	0
164	*Sambucus cerulea*	6	2	6	0	3	4	2	2	2
139	*Shepherdia canadensis*	2	2	2	4	2	4	2	6	4
140	*Sorbus scopulina*	6	0	6	4	0	0	2	2	6
142	*Spiraea betulifolia*	4	2	0	4	2	3	0	0	0
143	*Symphoricarpos albus*	4	2	6	6	2	4	2	2	2
163	*Symphoricarpos oreophilus*	4	3	4	0	2	3	2	2	2
145	*Vaccinium caespitosum*	0	0	0	0	0	0	0	0	0
307	*Calamagrostis rubescens*	—	—	—	—	—	—	—	—	—

Years since disturbance - average:
- range:

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

[2]Based on palatability ratings by Kufeld and others (1973), Kufeld (1973), USDA FS (1986), and Beecham (1981).

(con.)

APPENDIX A-2 (Con.)

Code No.	SHRUB LAYER GROUP	*Artemisia tridentata*			*Ceanothus velutinus*			*Ribes cereum*			*Symphoricarpos oreophilus*	
	Shrub layer type	ARTR -CEVE	ARTR -RICE	ARTR -CARU	CEVE -CEVE	CEVE -RICE	CEVE -CARU	RICE -RICE	RICE -SYOR	RICE -CARU	SYOR -SYOR	SYOR -CARU
	Number of stands	*n* = 2	*n* = 1	*n* = 4	*n* = 4	*n* = 2	*n* = 2	*n* = 5	*n* = 5	*n* = 4	*n* = 1	*n* = 8
	Shrub species											
102	*Acer glabrum*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)
105	*Amelanchier alnifolia*	0(0.0)	0(0.0)	0(0.0)	5(1.8)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	1(3.0)
201	*Arctostaphylos uva-ursi*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
150	*Artemisia tridentata*	10(15.0)	10(0.5)	10(26.3)	8(0.5)	0(0.0)	5(0.5)	6(0.5)	6(2.2)	8(1.3)	0(0.0)	1(0.5)
203	*Berberis repens*	5(0.5)	10(0.5)	8(2.2)	0(0.0)	0(0.0)	10(0.5)	4(0.5)	4(0.5)	8(0.5)	10(0.5)	6(6.8)
107	*Ceanothus velutinus*	10(37.5)	10(15.0)	3(0.5)	10(79.4)	10(26.3)	10(37.5)	2(0.5)	0(0.0)	0(0.0)	0(0.0)	3(1.8)
108	*Chrysothamnus nauseosus*	10(0.5)	10(15.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	6(0.5)	4(0.5)	3(0.5)	0(0.0)	0(0.0)
152	*Chrysothamnus viscidiflorus*	0(0.0)	0(0.0)	3(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
115	*Lonicera utahensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
123	*Prunus emarginata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
124	*Prunus virginiana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
125	*Purshia tridentata*	0(0.0)	0(0.0)	3(15.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
128	*Ribes cereum*	10(20.3)	10(15.0)	3(3.0)	5(1.8)	10(26.3)	5(0.5)	10(33.0)	10(15.0)	10(15.0)	10(3.0)	4(2.2)
131	*Ribes viscosissimum*	0(0.0)	10(15.0)	0(0.0)	5(1.8)	0(0.0)	5(0.5)	2(3.0)	6(0.5)	3(3.0)	0(0.0)	3(1.8)
161	*Rosa nutkana*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
137	*Salix scouleriana*	0(0.0)	10(0.5)	5(1.8)	8(13.7)	5(0.5)	5(3.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	3(1.8)
164	*Sambucus cerulea*	5(0.5)	10(0.5)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
139	*Shepherdia canadensis*	0(0.0)	0(0.0)	3(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
140	*Sorbus scopulina*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
142	*Spiraea betulifolia*	0(0.0)	0(0.0)	3(0.5)	3(0.5)	0(0.0)	0(0.5)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
143	*Symphoricarpos albus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
163	*Symphoricarpos oreophilus*	10(9.0)	10(0.5)	8(6.2)	10(1.8)	10(9.0)	10(9.0)	10(12.1)	10(24.5)	10(2.4)	10(37.5)	10(15.0)
145	*Vaccinium caespitosum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
307	*Calamagrostis rubescens*	10(15.0)	10(37.5)	10(61.9)	10(22.6)	10(9.0)	10(62.5)	10(4.4)	10(12.1)	10(55.6)	10(3.0)	10(55.6)
	Years since disturbance - average:	12	21	21	22	19	19	18	16	17	22	36
	- range:	8-16	21	21	12-38	16-22	19	13-26	15-17	13-19	22	5-90

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95; 10 = >95-100%

APPENDIX B-1: PALATABILITY RATINGS, CONSTANCY,[1] AND AVERAGE CANOPY COVER (PERCENT) OF HERB LAYER SPECIES BY LAYER TYPE IN THE PSME/CARU H.T., PIPO PHASE

HERB LAYER GROUP											ANNUALS			
Herb layer type											ANN. -ANN.	ANN. -POGL	ANN. -CAGE	ANN. -CARU
Number of stands											*n* = 1	*n* = 2	*n* = 1	*n* = 2
Code	Palatibility ratings[2]	Deer		Elk		Cattle	Sheep	Black bear						
No.	Perennial graminoids	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall				
301	*Agropyron spicatum*	2	4	4	6	4	2	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
303	*Bromus carinatus*	4	2	6	4	6	4	0	0	0	10(0.5)	0(0.0)	0(0.0)	5(0.5)
282	*Bromus inermis*	4	4	6	4	6	4	0	0	0	10(0.5)	0(0.0)	0(0.0)	0(0.0)
307	*Calamagrostis rubescens*	2	4	6	4	6	4	6	4	2	10(3.0)	10(15.0)	10(3.0)	10(26.3)
#05	*Carex* spp.	4	2	4	4	4	4	6	4	2	0(0.0)	5(0.5)	0(0.0)	0(0.0)
308	*Carex concinnoides*	4	4	4	4	4	2	0	0	0	0(0.0)	5(0.5)	0(0.0)	0(0.0)
309	*Carex geyeri*	4	4	6	6	6	4	6	4	2	10(3.0)	10(3.0)	10(15.0)	5(3.0)
311	*Carex rossii*	2	2	4	2	2	4	6	4	2	10(0.5)	10(15.0)	0(0.0)	5(3.0)
317	*Festuca idahoensis*	4	4	4	6	6	6	0	0	0	0(0.0)	10(0.5)	0(0.0)	5(0.5)
318	*Festuca occidentalis*	4	4	4	6	6	6	0	0	0	10(0.5)	0(0.0)	0(0.0)	0(0.0)
#07	*Poa* spp.	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
396	*Poa compressa*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
331	*Poa nervosa*	4	2	6	4	4	4	0	0	0	10(0.5)	0(0.0)	0(0.0)	5(15.0)
357	*Sitanion hystrix*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
360	*Stipa occidentalis*	0	0	0	0	0	0	0	0	0	0(0.0)	5(0.5)	0(0.0)	5(0.5)
	Perennial herbs													
401	*Achillea millefolium*	2	2	2	2	2	4	0	0	0	10(0.5)	5(0.5)	10(0.5)	0(0.0)
568	*Agoseris glauca*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
414	*Antennaria microphylla*	4	2	0	2	2	4	0	0	0	10(0.5)	10(0.5)	10(0.5)	5(0.5)
413	*Antennaria racemosa*	4	2	2	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
415	*Apocynum androsaemifolium*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	10(3.0)	0(0.0)
419	*Arenaria congesta*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
420	*Arenaria macrophylla*	2	0	2	0	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
421	*Arnica cordifolia*	4	0	4	0	2	4	0	0	0	0(0.0)	5(0.5)	0(0.0)	5(0.5)
#12	*Aster* spp.	4	4	4	4	4	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	5(3.0)
426	*Aster conspicuus*	2	2	4	2	4	4	0	0	0	10(0.5)	0(0.0)	0(0.0)	0(0.0)
586	*Aster perelegans*	4	2	4	2	4	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
431	*Balsamorhiza sagittata*	4	4	2	4	4	6	0	0	0	0(0.0)	0(0.0)	0(0.0)	5(0.5)

[1]Code to constancy values: + = 0-5% 2 = >15-25% 4 = >35-45% 6 = >55-65% 8 = >75-85% 10 = >95-100%
1 = >5-15% 3 = >25-35% 5 = >45-55% 7 = >65-75% 9 = >85-95%

[2]Based on palatability ratings by Kufeld and others (1973), Kufeld (1973), USDA FS (1986), and Beecham (1981).

Genus listing.

(con.)

APPENDIX B-1 (Con.)

											ANNUALS			
HERB LAYER GROUP														
Herb layer type											ANN. -ANN.	ANN. -POGL	ANN. -CAGE	ANN. -CARU
Number of stands											*n* = 1	*n* = 2	*n* = 1	*n* = 2
		Deer		Elk		Cattle	Sheep	Black bear						
	Palatability ratings[2]	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall				
736	*Castilleja applegatei*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
438	*Castilleja miniata*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
459	*Epilobium angustifolium*	4	2	6	2	2	4	0	0	0	10(0.5)	10(0.5)	10(0.5)	5(0.5)
467	*Fragaria* spp.	4	4	2	4	2	4	2	6	2	0(0.0)	0(0.0)	0(0.0)	0(0.0)
465	*Fragaria vesca*	4	4	2	4	2	4	2	6	2	10(0.0)	0(0.0)	0(0.0)	5(0.5)
466	*Fragaria virginiana*	2	2	2	4	2	4	2	6	2	0(0.0)	10(1.8)	0(0.0)	5(3.0)
615	*Frasera montana*	2	2	4	2	4	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
616	*Frasera speciosa*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
473	*Geranium viscosissimum*	4	2	6	2	2	4	0	0	0	0(0.0)	10(1.8)	0(0.0)	5(3.0)
628	*Hackelia micrantha*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
483	*Hieracium albertinum*	4	2	4	2	6	6	0	0	0	10(0.5)	5(0.5)	10(0.5)	5(0.5)
484	*Hieracium albiflorum*	4	2	4	2	6	6	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
833	*Iliamna rivularis*	4	0	6	0	4	6	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
495	*Lithospermum ruderale*	4	2	4	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	5(0.5)
499	*Lupinus* spp.	4	2	2	4	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
641	*Lupinus argenteus*	4	2	4	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
728	*Lupinus caudatus*	4	2	4	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
643	*Lupinus sericeus*	2	2	4	6	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	10(0.5)
500	*Microseris nutans*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
505	*Osmorhiza chilensis*	2	0	2	0	2	4	6	4	2	0(0.0)	0(0.0)	0(0.0)	0(0.0)
#23	*Penstemon* spp.	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
658	*Penstemon attenuatus*	4	2	2	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
716	*Penstemon fruticosus*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
513	*Penstemon procerus*	2	2	2	2	2	2	0	0	0	0(0.0)	0(0.0)	10(0.5)	0(0.0)
514	*Penstemon wilcoxii*	4	2	2	2	2	4	0	0	0	10(3.0)	10(1.8)	0(0.0)	10(0.5)
522	*Potentilla glandulosa*	4	2	4	2	2	4	0	0	0	0(0.0)	5(0.5)	10(0.3)	0(0.5)
670	*Potentilla gracilis*	4	2	2	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.5)

[1]Code to constancy values: + = 0-5%, 1 = >5-15%, 2 = >15-25%, 3 = >25-35%, 4 = >35-45%, 5 = >45-55%, 6 = >55-65%, 7 = >65-75%, 8 = >75-85%, 9 = >85-95%, 10 = >95-100%

[2]Based on palatability ratings by Kufeld and others (1973), Kufeld (1973), USDA FS (1986), and Beecham (1981).

Genus listing.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP											ANNUALS			
Herb layer type											ANN. -ANN.	ANN. -POGL	ANN. -CAGE	ANN. -CARU
Number of stands											*n* = 1	*n* = 2	*n* = 1	*n* = 2
		Deer		Elk		Cattle	Sheep	Black bear						
	Palatibility ratings[2]	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall				
*06	*Rumex acetosella*	2	0	2	2	2	2	0	0	0	0(0.0)	10(1.8)	0(0.0)	5(0.5)
681	*Senecio streptanthifolius*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
541	*Silene menziesii*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
542	*Smilacina racemosa*	6	2	4	2	2	4	6	4	2	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*08	*Taraxacum officinale*	0	0	0	0	0	0	6	4	2	0(0.0)	0(0.0)	0(0.0)	0(0.0)
547	*Thalictrum occidentale*	4	2	6	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	5(3.0)
*09	*Tragopogon dubius*	4	2	4	4	4	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	5(0.5)
691	*Veratrum californicum*	4	2	4	2	4	4	2	2	2	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Annuals, biennials, and short-lived perennials													
995	Annual	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)	5(15.0)
*11	*Bromus tectorum*	2	4	2	4	2	2	0	0	0	0(0.0)	10(1.8)	0(0.0)	10(3.0)
*12	*Cirsium vulgare*	2	2	2	2	2	2	0	0	0	10(15.0)	5(0.5)	0(0.0)	0(0.0)
902	*Collinsia parviflora*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)	5(0.5)
903	*Collomia linearis*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
921	*Collomia tenella*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
922	*Epilobium minutum*	2	0	2	0	2	2	0	0	0	10(15.0)	10(7.8)	10(3.0)	0(0.0)
905	*Galium aparine*	2	0	2	0	2	2	6	4	2	0(0.0)	0(0.0)	0(0.0)	0(0.0)
930	*Gayophytum decipiens*	2	0	2	0	2	2	0	0	0	0(0.0)	5(0.15)	0(0.0)	10(7.8)
916	*Gayophytum nuttallii*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	10(3.0)	0(0.0)
886	*Gnaphalium microcephalum*	2	0	2	0	2	4	0	0	0	10(15.0)	5(0.5)	10(0.5)	0(0.0)
663	*Phacelia hastata* var. *hastata*	4	2	4	2	2	4	0	0	0	0(0.0)	5(0.0)	0(0.0)	10(0.5)
664	*Phacelia hastata* var. *leucophylla*	4	2	4	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)	0(0.0)
911	*Polygonum douglasii*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)	5(0.5)
*16	*Verbascum thapsus*	2	2	2	2	2	2	0	0	0	10(3.0)	10(1.8)	0(0.0)	0(0.0)
996	Moss										10(37.5)	10(3.0)	0(0.0)	5(0.5)
999	Bare soil										10(15.0)	5(15.0)	10(15.0)	10(26.3)
Years since disturbance - average:											3	10	17	15
- range:											3	6 - 14	17	14 - 16

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

[2]Based on palatability ratings by Kufeld and others (1973), Kufeld (1973), USDA FS (1986), and Beecham (1981).

* Nonnative species.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP		Bromus carinatus		Potentilla glandulosa					Geranium viscosissimum		
Herb layer type		BRCA -POGL	BRCA -CAGE	POGL -POGL	POGL -GEVI	POGL -APAN	POGL -FRVE	POGL -CAGE	GEVI -EPAN	GEVI -CAGE	GEVI -CARU
Number of stands		*n* = 1	*n* = 1	*n* = 1	*n* = 2	*n* = 2	*n* = 1	*n* = 3	*n* = 1	*n* = 3	*n* = 5
Code No.	**Perennial graminoids**										
301	*Agropyron spicatum*	0(0.0)	10(0.5)	0(0.0)	5(0.5)	0(0.0)	10(0.5)	3(0.5)	0(0.0)	0(0.0)	2(0.5)
303	*Bromus carinatus*	10(15.0)	10(3.0)	10(0.5)	5(0.5)	5(3.0)	0(0.0)	7(1.8)	0(0.0)	10(1.3)	0(0.0)
282	*Bromus inermis*	0(0.0)	10(15.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)
307	*Calamagrostis rubescens*	0(0.0)	10(15.0)	10(3.0)	10(0.5)	10(9.0)	10(15.0)	10(7.0)	10(15.0)	10(11.0)	10(26.1)
#05	*Carex* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	10(0.5)	0(0.0)	0(0.0)
308	*Carex concinnoides*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
309	*Carex geyeri*	10(3.0)	10(15.0)	10(15.0)	10(15.0)	10(3.0)	10(37.5)	10(22.5)	10(15.0)	10(37.5)	8(17.6)
311	*Carex rossii*	0(0.0)	10(0.5)	10(0.5)	5(0.5)	10(9.0)	10(0.5)	0(0.0)	10(0.5)	7(1.8)	8(0.5)
317	*Festuca idahoensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	10(15.0)	0(0.0)	0(0.0)	0(0.0)	4(0.5)
318	*Festuca occidentalis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)
#07	*Poa* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	2(0.5)
396	*Poa compressa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
331	*Poa nervosa*	0(0.0)	0(0.0)	10(0.5)	5(0.5)	5(3.0)	10(3.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)
357	*Sitanion hystrix*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
360	*Stipa occidentalis*	0(0.0)	0(0.0)	10(0.5)	5(0.5)	5(0.5)	10(3.0)	0(0.0)	0(0.0)	0(0.0)	4(1.8)
	Perennial herbs										
401	*Achillea millefolium*	10(0.5)	10(0.5)	10(0.5)	0(0.0)	10(0.5)	10(3.0)	10(0.5)	10(0.5)	7(0.5)	6(0.5)
568	*Agoseris glauca*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
414	*Antennaria microphylla*	0(0.0)	10(3.0)	10(0.5)	5(3.0)	5(3.0)	10(0.5)	3(0.5)	0(0.0)	3(0.5)	8(0.5)
413	*Antennaria racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
415	*Apocynum androsaemifolium*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(15.0)	0(0.0)	0(0.0)	10(0.5)	7(7.8)	8(1.1)
419	*Arenaria congesta*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
420	*Arenaria macrophylla*	0(0.0)	0(0.0)	10(0.5)	5(0.5)	5(0.5)	0(0.0)	3(0.5)	10(0.5)	3(0.5)	2(0.5)
421	*Arnica cordifolia*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	7(0.5)	0(0.0)	3(3.0)	8(14.6)
#12	*Aster* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)
426	*Aster conspicuus*	0(0.0)	10(15.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	3(3.0)	10(0.5)	7(1.8)	0(0.0)
586	*Aster perelegans*	10(0.5)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
431	*Balsamorhiza sagittata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

\# Genus listing.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP		*Bromus carinatus*		*Potentilla glandulosa*					*Geranium viscosissimum*		
Herb layer type		BRCA -POGL	BRCA -CAGE	POGL -POGL	POGL -GEVI	POGL -APAN	POGL -FRVE	POGL -CAGE	GEVI -EPAN	GEVI -CAGE	GEVI -CARU
Number of stands		*n* = 1	*n* = 1	*n* = 1	*n* = 2	*n* = 2	*n* = 1	*n* = 3	*n* = 1	*n* = 3	*n* = 5
736	*Castilleja applegatei*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
438	*Castilleja miniata*	0(0.0)	0(0.0)	0(0.0)	10(1.8)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)
459	*Epilobium angustifolium*	10(0.5)	10(0.5)	10(0.5)	10(1.8)	5(0.5)	10(0.5)	3(0.5)	10(37.5)	10(0.5)	6(2.2)
467	*Fragaria* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
465	*Fragaria vesca*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	3(0.5)	10(0.5)	7(0.5)	2(0.5)
466	*Fragaria virginiana*	0(0.0)	10(3.0)	0(0.0)	0(0.0)	10(1.8)	10(37.5)	0(0.0)	0(0.0)	7(9.0)	2(3.0)
615	*Frasera montana*	0(0.0)	0(0.0)	10(0.5)	10(0.5)	0(0.0)	0(0.0)	3(0.5)	10(0.5)	3(0.5)	4(0.5)
616	*Frasera speciosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
473	*Geranium viscosissimum*	10(3.0)	0(0.0)	10(3.0)	10(15.0)	0(0.0)	10(15.0)	3(15.0)	10(3.0)	10(15.0)	10(15.0)
628	*Hackelia micrantha*	10(0.5)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(1.8)	10(0.5)	0(0.0)	0(0.0)
483	*Hieracium albertinum*	0(0.0)	10(0.5)	10(0.5)	5(0.5)	0(0.0)	0(0.0)	7(0.5)	10(0.5)	3(0.5)	2(0.5)
484	*Hieracium albiflorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
833	*Iliamna rivularis*	10(0.5)	0(0.0)	10(0.5)	5(0.5)	5(0.5)	0(0.0)	7(7.8)	0(0.0)	0(0.0)	0(0.0)
495	*Lithospermum ruderale*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
499	*Lupinus* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
641	*Lupinus argenteus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
728	*Lupinus caudatus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
643	*Lupinus sericeus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(3.0)	0(0.0)	10(0.0)	10(0.5)	3(3.0)	2(3.0)
500	*Microseris nutans*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
505	*Osmorhiza chilensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	2(0.5)
#23	*Penstemon* spp.	0(0.0)	0(0.0)	0(0.0)	5(37.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
658	*Penstemon attenuatus*	0(0.0)	0(0.0)	10(0.5)	5(0.5)	0(0.0)	0(0.0)	7(0.5)	10(15.0)	0(0.0)	2(3.0)
716	*Penstemon fruticosus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
513	*Penstemon procerus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)
514	*Penstemon wilcoxii*	0(0.10)	10(0.5)	0(0.0)	0(0.0)	5(0.5)	10(0.5)	7(0.5)	10(0.5)	7(7.8)	4(0.5)
522	*Potentilla glandulosa*	10(15.0)	0(0.0)	10(62.5)	10(15.0)	10(7.8)	0(0.0)	10(10.2)	10(3.0)	7(1.8)	8(1.1)
670	*Potentilla gracilis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(15.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)

[1]Code to constancy values: + = 0-5% 1 = >5-15% 2 = >15-25% 3 = >25-35% 4 = >35-45% 5 = >45-55% 6 = >55-65% 7 = >65-75% 8 = >75-85% 9 = >85-95% 10 = >95-100%

Genus listing.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP		Bromus carinatus		Potentilla glandulosa					Geranium viscosissimum		
Herb layer type		BRCA -POGL	BRCA -CAGE	POGL -POGL	POGL -GEVI	POGL -APAN	POGL -FRVE	POGL -CAGE	GEVI -EPAN	GEVI -CAGE	GEVI -CARU
Number of stands		*n* = 1	*n* = 1	*n* = 1	*n* = 2	*n* = 2	*n* = 1	*n* = 3	*n* = 1	*n* = 3	*n* = 5
*06	*Rumex acetosella*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(37.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
681	*Senecio streptanthifolius*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
541	*Silene menziesii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(0.5)	2(0.5)
542	*Smilacina racemosa*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	3(0.5)	0(0.0)
*08	*Taraxacum officinale*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
547	*Thalictrum occidentale*	0(0.0)	0(0.0)	0(0.0)	5(3.0)	0(0.0)	10(0.5)	3(0.5)	10(15.0)	7(1.8)	2(0.5)
*09	*Tragopogon dubius*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
691	*Veratrum californicum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	7(1.8)	0(0.0)	0(0.0)	0(0.0)
	Annuals, biennials, and short-lived perennials										
995	Annual	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*11	*Bromus tectorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	3(3.0)	0(0.0)
*12	*Cirsium vulgare*	0(0.0)	10(0.5)	10(0.5)	5(0.5)	5(0.5)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)
902	*Collinsia parviflora*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	4(0.5)
903	*Collomia linearis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
921	*Collomia tenella*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
922	*Epilobium minutum*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	3(3.0)	0(0.0)	3(3.0)	0(0.0)
905	*Galium aparine*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)
930	*Gayophytum decipiens*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)
916	*Gayophytum nuttallii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)
886	*Gnaphalium microcephalum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	10(0.5)	7(0.5)	2(0.5)
663	*Phacelia hastata* var. *hastata*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	3(0.5)	10(0.5)	7(0.5)	2(0.5)
664	*Phacelia hastata* var. *leucophylla*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	3(0.5)	0(0.0)	3(0.5)	0(0.0)
911	*Polygonum douglasii*	10(0.5)	0(0.0)	0(0.0)	5(0.5)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*16	*Verbascum thapsus*	0(0.0)	10(0.5)	0(0.0)	5(0.5)	5(0.5)	0(0.0)	0(0.0)	10(0.5)	3(0.5)	2(0.5)
996	Moss	0(0.0)	10(3.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	10(0.5)	7(0.5)	6(0.5)
999	Bare soil	10(37.5)	10(15.0)	10(15.0)	10(37.5)	10(38.8)	0(0.0)	10(7.0)	10(3.0)	10(14.5)	10(3.4)
Years since disturbance	- average:	22	9	12	18	12	50	37	13	18	28
	- range:	22	9	12	12 - 24	5 - 19	50	11 - 90	13	11 - 25	14 - 38

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

* Nonnative species.

(con.)

APPENDIX B-1 (Con.)

HERB LAYER GROUP		Epilobium angustifolium	Apocynum androsaemifolium		Fragaria vesca		Lupinus		Carex geyeri		Calamagrostis rubescens
Herb layer type		EPAN -CARU	APAN -CAGE	APAN -CARU	FRVE -FRVE	FRVE -CARU	LUP. -CAGE	LUP. -CARU	CAGE -CAGE	CAGE -CARU	CARU -CARU
Number of stands		*n* = 2	*n* = 1	*n* = 3	*n* = 1	*n* = 2	*n* = 1	*n* = 2	*n* = 4	*n* = 14	*n* = 9
Code No.	**Perennial graminoids**										
301	*Agropyron spicatum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	3(0.5)
303	*Bromus carinatus*	5(0.5)	10(0.5)	0(0.0)	10(3.0)	5(3.0)	0(0.0)	0(0.0)	3(0.5)	2(0.5)	3(0.5)
282	*Bromus inermis*	0(0.0)	0(0.0)	3(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
307	*Calamagrostis rubescens*	10(50.0)	10(3.0)	10(34.3)	10(3.0)	10(26.3)	10(37.5)	10(32.8)	10(9.0)	9(26.6)	10(33.1)
#05	*Carex* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
308	*Carex concinnoides*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)
309	*Carex geyeri*	0(0.0)	10(37.5)	7(1.8)	10(0.5)	5(3.0)	10(62.5)	5(15.0)	10(26.3)	9(14.0)	10(2.7)
311	*Carex rossii*	0(0.0)	0(0.0)	7(0.5)	10(0.5)	10(0.5)	0(0.0)	5(0.5)	8(0.5)	5(1.2)	8(0.9)
317	*Festuca idahoensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	1(0.5)
318	*Festuca occidentalis*	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	3(3.0)	1(0.5)	0(0.0)
#07	*Poa* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(3.0)	0(0.0)	1(0.5)
396	*Poa compressa*	0(0.0)	10(0.5)	3(15.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
331	*Poa nervosa*	0(0.0)	0(0.0)	10(5.3)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	3(0.5)	8(6.1)	3(1.3)
357	*Sitanion hystrix*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
360	*Stipa occidentalis*	0(0.0)	10(0.5)	0(0.0)	10(0.5)	0(0.0)	10(0.5)	0(0.0)	3(0.5)	0(0.0)	1(0.5)
	Perennial herbs										
401	*Achillea millefolium*	0(0.0)	10(0.5)	7(0.5)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	5(0.5)	7(0.5)	8(0.5)
568	*Agoseris glauca*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
414	*Antennaria microphylla*	0(0.0)	0(0.0)	3(0.5)	10(0.5)	10(1.8)	10(0.5)	0(0.0)	3(0.5)	3(0.5)	4(0.5)
413	*Antennaria racemosa*	5(0.5)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	5(15.0)	0(0.0)	0(0.0)	1(0.5)
415	*Apocynum androsaemifolium*	5(0.5)	10(15.0)	10(11.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	5(1.8)	6(1.1)	3(0.5)
419	*Arenaria congesta*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
420	*Arenaria macrophylla*	0(0.0)	10(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	3(0.5)	4(1.3)	4(1.1)
421	*Arnica cordifolia*	10(9.0)	10(3.0)	10(25.2)	0(0.0)	5(3.0)	10(15.0)	10(26.3)	8(1.3)	7(17.6)	7(6.2)
#12	*Aster* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
426	*Aster conspicuus*	5(0.5)	0(0.0)	3(0.5)	10(0.5)	5(3.0)	0(0.0)	5(0.5)	3(0.5)	1(19.0)	1(3.0)
586	*Aster perelegans*	0(0.0)	0(0.0)	7(1.8)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	5(1.8)	1(7.8)	1(0.5)
431	*Balsamorhiza sagittata*	0(0.0)	0(0.0)	7(1.8)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	3(0.5)	2(0.5)

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

Genus listing.

(con.)

APPENDIX B-1 (Con.)

	HERB LAYER GROUP	*Epilobium angustifolium*	*Apocynum androsaemifolium*		*Fragaria vesca*		*Lupinus*		*Carex geyeri*		*Calamagrostis rubescens*
	Herb layer type	EPAN -CARU	APAN -CAGE	APAN -CARU	FRVE -FRVE	FRVE -CARU	LUP. -CAGE	LUP. -CARU	CAGE -CAGE	CAGE -CARU	CARU -CARU
	Number of stands	*n* = 2	*n* = 1	*n* = 3	*n* = 1	*n* = 2	*n* = 1	*n* = 2	*n* = 4	*n* = 14	*n* = 9
736	*Castilleja applegatei*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)
438	*Castilleja miniata*	0(0.0)	0(0.0)	3(3.0)	10(0.5)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	1(0.5)	0(0.0)
459	*Epilobium angustifolium*	10(15.0)	10(3.0)	3(0.5)	10(0.5)	10(0.5)	10(0.5)	0(0.0)	3(3.0)	4(0.5)	6(0.5)
467	*Fragaria* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
465	*Fragaria vesca*	10(0.5)	0(0.0)	0(0.0)	0(0.0)	5(15.0)	0(0.0)	10(1.8)	3(3.0)	4(1.0)	3(1.3)
466	*Fragaria virginiana*	0(0.0)	0(0.0)	0(0.0)	10(37.5)	5(15.0)	10(0.5)	0(0.0)	0(0.0)	3(1.1)	3(0.5)
615	*Frasera montana*	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	1(0.5)	3(0.5)
616	*Frasera speciosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)
473	*Geranium viscosissimum*	5(0.5)	10(3.0)	7(0.5)	10(0.5)	10(0.5)	10(3.0)	0(0.0)	3(0.5)	6(1.3)	7(0.9)
628	*Hackelia micrantha*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
483	*Hieracium albertinum*	0(0.0)	0(0.0)	7(0.5)	0(0.0)	5(0.5)	0(0.0)	5(0.5	5(0.5)	5(0.5)	6(1.0)
484	*Hieracium albiflorum*	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	5(1.8)	1(0.5)	2(0.5)
833	*Iliamna rivularis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
495	*Lithospermum ruderale*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	1(0.5)	0(0.0)
499	*Lupinus* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
641	*Lupinus argenteus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
728	*Lupinus caudatus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
643	*Lupinus sericeus*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	10(15.0)	0(0.0)	0(0.0)	1(3.0)	1(0.5)
500	*Microseris nutans*	0(0.0)	0(0.0)	7(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
505	*Osmorhiza chilensis*	5(0.5)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	3(0.5)	4(0.5)	0(0.0)
#23	*Penstemon* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
658	*Penstemon attenuatus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	2(1.8)
716	*Penstemon fruticosus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
513	*Penstemon procerus*	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
514	*Penstemon wilcoxii*	0(0.0)	10(3.0)	3(0.5)	0(0.0)	10(0.5)	0(0.0)	5(0.5)	0(0.0)	3(1.1)	3(0.5)
522	*Potentilla glandulosa*	0(0.0)	10(0.5)	3(0.5)	10(0.5)	5(0.5)	10(0.5)	0(0.0)	3(3.0)	6(0.8)	6(1.0)
670	*Potentilla gracilis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	5(0.5)	0(0.0)	0(0.0)	0(0.0)

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

Genus listing.

(con.)

APPENDIX B-1 (Con.)

	HERB LAYER GROUP	Epilobium angustifolium	Apocynum androsaemifolium		Fragaria vesca		Lupinus		Carex geyeri		Calamagrostis rubescens
	Herb layer type	EPAN -CARU	APAN -CAGE	APAN -CARU	FRVE -FRVE	FRVE -CARU	LUP. -CAGE	LUP. -CARU	CAGE -CAGE	CAGE -CARU	CARU -CARU
	Number of stands	*n* = 2	*n* = 1	*n* = 3	*n* = 1	*n* = 2	*n* = 1	*n* = 2	*n* = 4	*n* = 14	*n* = 9
*06	*Rumex acetosella*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	1(0.5)
681	*Senecio streptanthifolius*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)
541	*Silene menziesii*	0(0.0)	10(0.5)	3(0.5)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	5(1.8)	4(0.5)	2(0.5)
542	*Smilacina racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	3(3.0)	4(1.0)	1(0.5)
*08	*Taraxacum officinale*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
547	*Thalictrum occidentale*	5(0.5)	10(3.0)	0(0.0)	10(0.5)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	3(1.1)	2(0.5)
*09	*Tragopogon dubius*	0(0.0)	0(0.0)	7(0.5)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	3(0.5)	0(0.0)
691	*Veratrum californicum*	0(0.0)	0(0.0)	3(37.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(2.2)	0(0.0)
	Annuals, biennials, and short-lived perennials										
995	Annual	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*11	*Bromus tectorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*12	*Cirsium vulgare*	5(0.5)	0(0.0)	0(0.0)	10(0.5)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
902	*Collinsia parviflora*	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	3(1.1)	2(0.5)
903	*Collomia linearis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
921	*Collomia tenella*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)
922	*Epilobium minutum*	0(0.0)	0(0.0)	3(0.5)	10(0.5)	5(0.5)	0(0.0)	0(0.0)	3(0.5)	1(1.8)	2(0.5)
905	*Galium aparine*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	1(0.5)	1(0.5)
930	*Gayophytum decipiens*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	1(0.5)
916	*Gayophytum nuttallii*	0(0.0)	0(0.0)	3(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(1.8)	2(0.5)
886	*Gnaphalium microcephalum*	0(0.0)	0(0.0)	3(0.5)	10(0.5)	5(0.5)	0(0.0)	0(0.0)	3(0.5)	1(0.5)	1(3.0)
663	*Phacelia hastata* var. *hastata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	3(0.5)	1(0.5)	0(0.0)
664	*Phacelia hastata* var. *leucophylla*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	2(0.5)
911	*Polygonum douglasii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)
*16	*Verbascum thapsus*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	1(0.5)	1(0.5)
996	Moss	10(0.9)	0(0.0)	3(0.5)	10(0.5)	10(1.8)	0(0.0)	5(0.5)	0(0.0)	1(0.5)	2(1.8)
999	Bare soil	5(3.0)	10(0.5)	7(7.8)	10(15.0)	10(3.0)	0(0.0)	10(1.8)	5(15.0)	4(8.6)	4(5.4)
	Years since disturbance - average:	28	26	13	10	32	11	20	52	31	43
	- range:	6 - 50	26	10 - 17	10	19 - 46	11	11 - 30	12 - 100	6 - 100	6 - 75

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

* Nonnative species.

APPENDIX B-2: PALATABILITY RATINGS, CONSTANCY,[1] AND AVERAGE CANOPY COVER (PERCENT) OF HERB LAYER SPECIES BY LAYER TYPE IN THE PSME/CARU H.T., CARU PHASE

Code No.	HERB LAYER GROUP / Herb layer type / Number of stands / Palatability ratings[2]	Deer Summer	Deer Winter	Elk Summer	Elk Winter	Cattle Summer	Sheep Summer	Black bear Spring	Black bear Summer	Black bear Fall	ANNUALS: ANN. -POGL (n = 1)	ANNUALS: ANN. -EPAN (n = 1)	ANNUALS: ANN. -CARU (n = 2)
	Perennial graminoids												
301	*Agropyron spicatum*	2	4	4	6	4	2	0	0	0	0(0.0)	0(0.0)	0(0.0)
303	*Bromus carinatus*	4	2	6	4	6	4	0	0	0	10(0.5)	10(3.0)	5(3.0)
282	*Bromus inermis*	4	4	6	4	6	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
307	*Calamagrostis rubescens*	2	4	6	4	6	4	6	4	2	10(3.0)	10(3.0)	10(50.0)
#05	*Carex* spp.	4	2	4	4	4	4	6	4	2	0(0.0)	0(0.0)	0(3.0)
308	*Carex concinnoides*	4	4	4	4	4	2	0	0	0	0(0.0)	0(0.0)	5(3.0)
309	*Carex geyeri*	4	4	6	6	6	4	6	4	2	10(3.0)	10(15.0)	5(0.5)
311	*Carex rossii*	2	2	4	2	2	4	6	4	2	10(0.5)	0(0.0)	10(9.0)
317	*Festuca idahoensis*	4	4	4	6	6	6	0	0	0	10(0.5)	10(0.5)	0(0.0)
318	*Festuca occidentalis*	4	4	4	6	6	6	0	0	0	0(0.0)	0(0.0)	0(0.0)
#07	*Poa* spp.	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
396	*Poa compressa*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
331	*Poa nervosa*	4	2	6	4	4	4	0	0	0	0(0.0)	0(0.0)	10(0.5)
357	*Sitanion hystrix*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
360	*Stipa occidentalis*	0	0	0	0	0	0	0	0	0	10(0.5)	0(0.0)	0(0.0)
	Perennial herbs												
401	*Achillea millefolium*	2	2	2	2	2	4	0	0	0	10(0.5)	10(3.0)	10(0.5)
568	*Agoseris glauca*	0	0	0	0	0	0	0	0	0	10(0.5)	10(0.5)	5(0.5)
414	*Antennaria microphylla*	4	2	0	2	2	4	0	0	0	10(0.5)	0(0.0)	10(0.5)
413	*Antennaria racemosa*	4	2	2	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
415	*Apocynum androsaemifolium*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)
419	*Arenaria congesta*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
420	*Arenaria macrophylla*	2	0	2	0	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
421	*Arnica cordifolia*	4	0	4	0	2	4	0	0	0	0(0.0)	10(0.5)	10(3.0)
#12	*Aster* spp.	4	4	4	4	4	4	0	0	0	10(3.0)	0(0.0)	0(0.0)
426	*Aster conspicuus*	2	2	4	2	4	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
586	*Aster perelegans*	4	2	4	2	4	4	0	0	0	0(0.0)	0(0.0)	5(0.5)
431	*Balsamorhiza sagittata*	4	4	2	4	4	6	0	0	0	0(0.0)	0(0.0)	0(0.0)

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

[2]Based on palatability ratings by Kufeld and others (1973), Kufeld (1973), USDA FS (1986), and Beecham (1981).

Genus listing.

(con.)

APPENDIX B-2 (Con.)

Code No.	Palatability ratings[2] Perennial graminoids	Deer Summer	Deer Winter	Elk Summer	Elk Winter	Cattle Summer	Sheep Summer	Black bear Spring	Black bear Summer	Black bear Fall	ANNUALS: ANN.-POGL	ANNUALS: ANN.-EPAN	ANNUALS: ANN.-CARU
HERB LAYER GROUP											ANNUALS		
Herb layer type											ANN.-POGL	ANN.-EPAN	ANN.-CARU
Number of stands											$n = 1$	$n = 1$	$n = 2$
736	*Castilleja applegatei*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)
438	*Castilleja miniata*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	5(0.5)
459	*Epilobium angustifolium*	4	2	6	2	2	4	0	0	0	10(0.5)	10(15.0)	5(0.5)
467	*Fragaria* spp.	4	4	2	4	2	4	2	6	2	0(0.0)	0(0.0)	5(0.5)
465	*Fragaria vesca*	4	4	2	4	2	4	2	6	2	10(0.5)	0(0.0)	0(0.0)
466	*Fragaria virginiana*	2	2	2	4	2	4	2	6	2	10(0.5)	0(0.0)	0(0.0)
615	*Frasera montana*	2	2	4	2	4	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
616	*Frasera speciosa*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
473	*Geranium viscosissimum*	4	2	6	2	2	4	0	0	0	10(15.0)	10(0.5)	5(0.5)
628	*Hackelia micrantha*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	5(0.5)
483	*Hieracium albertinum*	4	2	4	2	6	6	0	0	0	0(0.0)	10(0.5)	0(0.0)
484	*Hieracium albiflorum*	4	2	4	2	6	6	0	0	0	0(0.0)	0(0.0)	5(0.5)
833	*Iliamna rivularis*	4	0	6	0	4	6	0	0	0	0(0.0)	0(0.0)	0(0.0)
495	*Lithospermum ruderale*	4	2	4	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
499	*Lupinus* spp.	4	2	2	4	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
641	*Lupinus argenteus*	4	2	4	2	2	4	0	0	0	10(3.0)	10(0.5)	0(0.0)
728	*Lupinus caudatus*	4	4	4	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
643	*Lupinus sericeus*	2	2	4	6	2	4	0	0	0	0(0.0)	0(0.0)	5(3.0)
500	*Microseris nutans*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
505	*Osmorhiza chilensis*	2	0	2	0	2	4	6	4	2	0(0.0)	0(0.0)	5(0.5)
#23	*Penstemon* spp.	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
658	*Penstemon attenuatus*	4	2	2	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
716	*Penstemon fruticosus*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
513	*Penstemon procerus*	2	2	2	2	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)
514	*Penstemon wilcoxii*	4	2	2	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
522	*Potentilla glandulosa*	4	2	4	2	2	4	0	0	0	10(15.0)	10(0.5)	10(1.8)
670	*Potentilla gracilis*	4	2	2	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)

[1]Code to constancy values: + = 0-5%, 1 = >5-15%, 2 = >15-25%, 3 = >25-35%, 4 = >35-45%, 5 = >45-55%, 6 = >55-65%, 7 = >65-75%, 8 = >75-85%, 9 = >85-95%, 10 = >95-100%

[2]Based on palatability ratings by Kufeld and others (1973), Kufeld (1973), USDA FS (1986), and Beecham (1981).

Genus listing.

(con.)

APPENDIX B-2 (Con.)

HERB LAYER GROUP											ANNUALS		
Herb layer type											ANN. -POGL	ANN. -EPAN	ANN. -CARU
Number of stands											*n* = 1	*n* = 1	*n* = 2
		Deer		Elk		Cattle	Sheep	Black bear					
	Palatability ratings[2]	Summer	Winter	Summer	Winter	Summer	Summer	Spring	Summer	Fall			
*06	*Rumex acetosella*	2	0	2	2	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)
681	*Senecio streptanthifolius*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
541	*Silene menziesii*	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
542	*Smilacina racemosa*	6	2	4	2	2	4	6	4	2	0(0.0)	0(0.0)	0(0.0)
*08	*Taraxacum officinale*	0	0	0	0	0	0	6	4	2	0(0.0)	10(0.5)	10(0.5)
547	*Thalictrum occidentale*	4	2	6	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
*09	*Tragopogon dubius*	4	2	4	4	4	4	0	0	0	0(0.0)	0(0.0)	5(0.5)
691	*Veratrum californicum*	4	2	4	2	4	4	2	2	2	0(0.0)	0(0.0)	0(0.0)
	Annuals, biennials, and short-lived perennials												
995	Annual	0	0	0	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
*11	*Bromus tectorum*	2	4	2	4	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)
*12	*Cirsium vulgare*	2	2	2	2	2	2	0	0	0	0(0.0)	0(0.0)	5(0.5)
902	*Collinsia parviflora*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	10(7.8)
903	*Collomia linearis*	2	0	2	0	2	2	0	0	0	10(15.0)	0(0.0)	0(0.0)
921	*Collomia tenella*	2	0	2	0	2	2	0	0	0	0(0.0)	10(15.0)	0(0.0)
922	*Epilobium minutum*	2	0	2	0	2	2	0	0	0	10(0.5)	0(0.0)	0(0.0)
905	*Galium aparine*	2	0	2	0	2	2	6	4	2	0(0.0)	0(0.0)	0(0.0)
930	*Gayophytum decipiens*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	5(15.0)
916	*Gayophytum nuttallii*	2	0	2	0	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)
886	*Gnaphalium microcephalum*	2	0	2	0	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
663	*Phacelia hastata* var. *hastata*	4	2	4	2	2	4	0	0	0	0(0.0)	0(0.0)	10(0.5)
664	*Phacelia hastata* var. *leucophylla*	4	2	4	2	2	4	0	0	0	0(0.0)	0(0.0)	0(0.0)
911	*Polygonum douglasii*	2	0	2	0	2	2	0	0	0	10(3.0)	10(3.0)	0(0.0)
*16	*Verbascum thapsus*	2	2	2	2	2	2	0	0	0	0(0.0)	0(0.0)	0(0.0)
	Misc.												
996	Moss										0(0.0)	0(0.0)	10(0.5)
999	Bare soil										10(15.0)	10(3.0)	10(26.3)
Years since disturbance - average:											18	16	7
- range:											18	16	5-9

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

[2]Based on palatability ratings by Kufeld and others (1973), Kufeld (1973), USDA FS (1986), and Beecham (1981).

* Nonnative species.

(con.)

APPENDIX B-2 (Con.)

HERB LAYER GROUP		Bromus carinatus				Carex rossii				Geranium viscosissimum		
Herb layer type		BRCA -GEVI	BRCA -FRVE	BRCA -CAGE	BRCA -CARU	CARO -CARO	CARO -EPAN	CARO -CAGE	CARO -CARU	GEVI -LUP.	GEVI -CAGE	GEVI -CARU
Number of stands		*n* = 1	*n* = 1	*n* = 2	*n* = 4	*n* = 1	*n* = 1	*n* = 3	*n* = 6	*n* = 1	*n* = 2	*n* = 1
Code No.	Perennial graminoids											
301	*Agropyron spicatum*	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
303	*Bromus carinatus*	10(15.0)	10(15.0)	10(26.3)	10(12.0)	0(0.0)	0(0.0)	3(3.0)	3(1.8)	10(0.5)	10(0.5)	10(0.5)
282	*Bromus inermis*	0(0.0)	10(15.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)
307	*Calamagrostis rubescens*	10(0.5)	10(15.0)	10(9.0)	10(44.4)	10(3.0)	10(0.5)	10(30.0)	10(50.0)	10(15.0)	10(9.0)	10(85.0)
#05	*Carex* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
308	*Carex concinnoides*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	10(0.5)	0(0.0)	0(0.0)	2(3.0)	0(0.0)	0(0.0)	0(0.0)
309	*Carex geyeri*	10(3.0)	0(0.0)	10(37.5)	5(3.0)	10(3.0)	10(37.5)	8(2.5)	0(0.0)	10(37.5)	10(15.0)	10(15.0)
311	*Carex rossii*	10(0.5)	10(0.5)	5(0.5)	8(2.2)	10(15.0)	10(3.0)	10(11.0)	8.15.5)	10(3.0)	5(0.5)	0(0.0)
317	*Festuca idahoensis*	10(0.5)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	5(1.3)	0(0.0)	0(0.0)	10(3.0)
318	*Festuca occidentalis*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
#07	*Poa* spp.	0(0.0)	0(0.0)	0(0.0)	3(3.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
396	*Poa compressa*	0(0.0)	10(0.5)	0(0.0)	3(15.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
331	*Poa nervosa*	0(0.0)	0(0.0)	5(0.5)	8(1.3)	10(0.5)	0(0.0)	3(0.5)	5(5.3)	0(0.0)	0(0.0)	0(0.0)
357	*Sitanion hystrix*	10(0.5)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
360	*Stipa occidentalis*	10(0.5)	10(0.5)	5(3.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	5(0.5)	0(0.0)
	Perennial herbs											
401	*Achillea millefolium*	0(0.0)	10(0.5)	5(0.5)	8(0.5)	10(0.5)	10(0.5)	7(0.5)	5(0.5)	10(0.5)	5(0.5)	0(0.0)
568	*Agoseris glauca*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	10(1.8)	0(0.0)
414	*Antennaria microphylla*	0(0.0)	10(0.5)	5(0.5)	8(1.3)	10(0.5)	0(0.0)	7(0.5)	8(0.5)	0(0.0)	5(0.5)	0(0.0)
413	*Antennaria racemosa*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
415	*Apocynum androsaemifolium*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
419	*Arenaria congesta*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
420	*Arenaria macrophylla*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(3.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
421	*Arnica cordifolia*	0(0.0)	10(0.5)	0(0.0)	8(15.0)	10(0.5)	10(0.5)	7(0.5)	5(14.5)	0(0.0)	5(3.0)	0(0.0)
#12	*Aster* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	5(0.5)	0(0.0)
426	*Aster conspicuus*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	10(0.5)	3(0.5)	2(3.0)	0(0.0)	0(0.0)	0(0.0)
586	*Aster perelegans*	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
431	*Balsamorhiza sagittata*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

Genus listing.

(con.)

APPENDIX B-2 (Con.)

HERB LAYER GROUP		Bromus carinatus				Carex rossii				Geranium viscosissimum		
Herb layer type		BRCA -GEVI	BRCA -FRVE	BRCA -CAGE	BRCA -CARU	CARO -CARO	CARO -EPAN	CARO -CAGE	CARO -CARU	GEVI -LUP.	GEVI -CAGE	GEVI -CARU
Number of stands		*n* = 1	*n* = 1	*n* = 2	*n* = 4	*n* = 1	*n* = 1	*n* = 3	*n* = 6	*n* = 1	*n* = 2	*n* = 1
736	*Castilleja applegatei*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
438	*Castilleja miniata*	10(0.5)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	3(0.5)	2(0.5)	10(0.5)	5(15.0)	0(0.0)
459	*Epilobium angustifolium*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	10(0.5)	10(37.5)	3(0.5)	5(0.5)	10(15.0)	10(3.0)	0(0.0)
467	*Fragaria* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
465	*Fragaria vesca*	0(0.0)	10(15.0)	0(0.0)	3(3.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
466	*Fragaria virginiana*	0(0.0)	0(0.0)	5(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	10(0.5)	5(3.0)	0(0.0)
615	*Frasera montana*	10(3.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
616	*Frasera speciosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
473	*Geranium viscosissimum*	10(15.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	7(1.8)	2(0.5)	10(15.0)	10(15.0)	0(0.0)
628	*Hackella micrantha*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
483	*Hieracium albertinum*	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	2(0.5)	0(0.0)	0(0.0)	10(0.5)
484	*Hieracium albiflorum*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	10(0.5)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
833	*Iliamna rivularis*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
495	*Lithospermum ruderale*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
499	*Lupinus* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(3.0)	0(0.0)	0(0.0)	2(3.0)	0(0.0)	0(0.0)	10(3.0)
641	*Lupinus argenteus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(1.8)	10(37.5)	10(3.0)	0(0.0)
728	*Lupinus caudatus*	0(0.0)	10(0.5)	0(0.0)	3(3.0)	0(0.0)	0(0.0)	0(0.0)	2(15.0)	0(0.0)	0(0.0)	0(0.0)
643	*Lupinus sericeus*	10(3.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	3(15.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
500	*Microseris nutans*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)
505	*Osmorhiza chilensis*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)
#23	*Penstemon* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
658	*Penstemon attenuatus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	3(0.5)	3(0.5)	0(0.0)	0(0.0)	10(15.0)
716	*Penstemon fruticosus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
513	*Penstemon procerus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
514	*Penstemon wilcoxii*	0(0.0)	0(0.0)	5(0.5)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
522	*Potentilla glandulosa*	0(0.0)	10(0.5)	5(0.5)	8(1.3)	0(0.0)	10(15.0)	7(7.8)	5(10.2)	10(0.5)	10(0.5)	0(0.0)
670	*Potentilla gracilis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

Genus listing.

(con.)

APPENDIX B-2 (Con.)

HERB LAYER GROUP		Bromus carinatus				Carex rossii				Geranium viscosissimum		
Herb layer type		BRCA -GEVI	BRCA -FRVE	BRCA -CAGE	BRCA -CARU	CARO -CARO	CARO -EPAN	CARO -CAGE	CARO -CARU	GEVI -LUP.	GEVI -CAGE	GEVI -CARU
Number of stands		*n* = 1	*n* = 1	*n* = 2	*n* = 4	*n* = 1	*n* = 1	*n* = 3	*n* = 6	*n* = 1	*n* = 2	*n* = 1
*06	*Rumex acetosella*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
681	*Senecio streptanthifolius*	0(0.0)	0(0.0)	0(0.0)	3(3.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.5)
541	*Silene menziesii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
542	*Smilacina racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(15.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*08	*Taraxacum officinale*	0(0.0)	10(0.5)	0(0.0)	8(0.5)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	10(0.5)	5(0.5)	0(0.0)
547	*Thalictrum occidentale*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*09	*Tragopogon dubius*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	3(0.5)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
691	*Veratrum californicum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Annuals, biennials, and short-lived perennials											
995	Annual	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*11	*Bromus tectorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*12	*Cirsium vulgare*	0(0.0)	10(0.5)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
902	*Collinsia parviflora*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
903	*Collomia linearis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	0(0.0)	0(0.0)
921	*Collomia tenella*	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	10(1.8)	0(0.0)
922	*Epilobium minutum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)
905	*Galium aparine*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
930	*Gayophytum decipiens*	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	0(0.0)	0(0.0)
916	*Gayophytum nuttallii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
886	*Gnaphalium microcephalum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
663	*Phacelia hastata* var. *hastata*	10(0.5)	0(0.0)	10(0.5)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)
664	*Phacelia hastata* var. *leucophylla*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
911	*Polygonum douglasii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	10(0.5)	5(0.5)	0(0.0)
*16	*Verbascum thapsus*	0(0.0)	10(0.5)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Misc.											
996	Moss	0(0.0)	0(0.0)	0(0.0)	5(1.8)	0(0.0)	0(0.0)	7(0.5)	7(1.1)	0(0.0)	5(0.5)	0(0.0)
999	Bare soil	10(37.5)	10(0.5)	10(26.3)	10(11.6)	10(15.0)	10(0.5)	7(9.0)	10(9.0)	10(0.5)	10(3.0)	0(0.0)
Years since disturbance	- average:	16	19	16	15	8	38	14	16	18	17	—
	- range:	16	19	15-18	12-18	8	38	11-16	4-24	18	15-19	—

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

* Nonnative species.

(con.)

APPENDIX B-2 (Con.)

Code No.	HERB LAYER GROUP	*Epilobium angustifolium*	*Antennaria microphylla*	*Fragaria vesca*	*Lupinus* spp.		*Carex geyeri*		*Calamagrostis rubescens*
	Herb layer type	EPAN -CARU	ANMI -CARU	FRVE -CARU	LUP. -CAGE	LUP. -CARU	CAGE -CAGE	CAGE -CARU	CARU -CARU
	Number of stands	*n* = 2	*n* = 3	*n* = 2	*n* = 2	*n* = 7	*n* = 6	*n* = 12	*n* = 25
	Perennial graminoids								
301	*Agropyron spicatum*	0(0.0)	3(0.5)	5(3.0)	0(0.0)	0(0.0)	7(0.5)	1(0.5)	1(0.5)
303	*Bromus carinatus*	0(0.0)	0(0.0)	10(1.8)	5(3.0)	1(3.0)	3(1.8)	3(1.3)	2(0.5)
282	*Bromus inermis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.5)
307	*Calamagrostis rubescens*	10(85.0)	10(38.3)	10(26.3)	10(15.0)	10(51.8)	10(6.2)	10(57.9)	10(65.0)
#05	*Carex* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
308	*Carex concinnoides*	0(0.0)	3(0.5)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	0(0.0)	1(1.3)
309	*Carex geyeri*	5(0.5)	3(0.5)	10(1.8)	10(20.3)	7(7.9)	10(41.7)	9(15.7)	6(1.3)
311	*Carex rossii*	0(0.0)	7(0.5)	10(1.8)	10(0.5)	9(0.5)	5(0.5)	3(1.3)	2(0.5)
317	*Festuca idahoensis*	0(0.0)	3(3.0)	10(0.5)	10(3.0)	6(0.5)	2(0.5)	3(5.3)	3(1.1)
318	*Festuca occidentalis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.5)
#07	*Poa* spp.	0(0.0)	3(0.5)	5(0.5)	0(0.0)	0(0.0)	2(0.5)	0(0.0)	1(9.0)
396	*Poa compressa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
331	*Poa nervosa*	10(0.5)	7(1.8)	5(3.0)	10(7.8)	4(13.7)	7(0.5)	7(5.9)	5(0.9)
357	*Sitanion hystrix*	0(0.0)	0(0.0)	5(0.5)	0(0.0)	3(1.8)	2(0.5)	3(0.5)	1(0.5)
360	*Stipa occidentalis*	0(0.0)	0(0.0)	0(0 0)	5(3.0)	1(0.5)	0(0.0)	1(0.5)	1(0.5)
	Perennial herbs								
401	*Achillea millefolium*	0(0.0)	0(0.0)	10(0.5)	10(0.5)	7(3.4)	5(0.5)	4(0.5)	5(0.7)
568	*Agoseris glauca*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	0(0.0)	1(0.5)
414	*Antennaria microphylla*	5(0.5)	10(22.5)	10(0.5)	10(1.8)	3(0.5)	7(0.5)	3(0.5)	6(0.5)
413	*Antennaria racemosa*	0(0.0)	3(0.5)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	0(0.0)	4(2.9)
415	*Apocynum androsaemifolium*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
419	*Arenaria congesta*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	1(0.5)	1(0.5)
420	*Arenaria macrophylla*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(3.0)
421	*Arnica cordifolia*	5(3.0)	7(9.0)	5(15.0)	5(0.5)	9(16.5)	2(0.5)	8(6.7)	8(25.9)
#12	*Aster* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)	0(0.5)
426	*Aster conspicuus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	1(3.0)	0(0.5)
586	*Aster perelegans*	5(0.5)	3(0.5)	0(0.0)	5(0.5)	3(0.5)	5(0.5)	3(1.3)	1(0.5)
431	*Balsamorhiza sagittata*	0(0.0)	3(3.0)	10(0.5)	5(0.5)	3(1.8)	2(0.5)	3(0.5)	1(1.3)

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

\# Genus listing.

(con.)

APPENDIX B-2 (Con.)

HERB LAYER GROUP		*Epilobium angustifolium*	*Antennaria microphylla*	*Fragaria vesca*	*Lupinus* spp.		*Carex geyeri*		*Calamagrostis rubescens*
Herb layer type		EPAN -CARU	ANMI -CARU	FRVE -CARU	LUP. -CAGE	LUP. -CARU	CAGE -CAGE	CAGE -CARU	CARU -CARU
Number of stands		*n* = 2	*n* = 3	*n* = 2	*n* = 2	*n* = 7	*n* = 6	*n* = 12	*n* = 25
736	*Castilleja applegatei*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
438	*Castilleja miniata*	10(0.5)	3(0.5)	5(0.5)	5(0.5)	0(0.0)	3(0.5)	2(1.8)	2(0.5)
459	*Epilobium angustifolium*	10(15.0)	3(0.5)	10(1.8)	0(0.0)	4(1.3)	2(0.5)	5(1.3)	3(0.8)
467	*Fragaria* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
465	*Fragaria vesca*	0(0.0)	3(0.5)	10(15.0)	0(0.0)	1(0.5)	0(0.0)	0(0.0)	4(0.5)
466	*Fragaria virginiana*	0(0.0)	3(3.0)	0(0.0)	0(0.0)	1(3.0)	2(0.5)	0(0.0)	1(0.5)
615	*Frasera montana*	0(0.0)	0(0.0)	0(0.0)	10(0.5)	3(0.5)	0(0.0)	2(0.5)	1(0.5)
616	*Frasera speciosa*	10(1.8)	3(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.5)
473	*Geranium viscosissimum*	5(3.0)	3(0.5)	0(0.0)	10(0.5)	1(0.5)	5(0.5)	1(0.5)	2(0.5)
628	*Hackelia micrantha*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	7(0.5)	0(0.0)	0(0.0)
483	*Hieracium albertinum*	5(0.5)	3(0.5)	5(0.5)	10(0.5)	6(0.5)	3(0.5)	5(0.5)	2(0.5)
484	*Hieracium albiflorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	0(0.0)	2(0.5)
833	*Iliamna rivularis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.5)	0(0.0)	1(1.3)
495	*Lithospernum ruderale*	0(0.0)	3(0.5)	5(0.5)	0(0.0)	1(0.5)	3(0.5)	1(0.5)	0(0.0)
499	*Lupinus* spp.	5(15.0)	0(0.0)	0(0 0)	0(0.0)	1(15.0)	0(0.0)	0(0.0)	1(1.3)
641	*Lupinus argenteus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(15.0)	0(0.0)	1(0.5)	2(1.8)
728	*Lupinus caudatus*	0(0.0)	7(7.8)	0(0.0)	0(0.0)	3(26.3)	0(0.0)	0(0.0)	0(3.0)
643	*Lupinus sericeus*	5(0.5)	3(0.5)	0(0.0)	10(15.0)	4(15.0)	8(1.5)	3(2.2)	1(0.5)
500	*Microseris nutans*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	1(0.5)	2(0.5)	0(0.0)	1(0.5)
505	*Osmorhiza chilensis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	2(0.5)
#23	*Penstemon* spp.	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	0(0.0)
658	*Penstemon attenuatus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	1(0.5)
716	*Penstemon fruticosus*	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	3(5.3)	2(1.0)
513	*Penstemon procerus*	0(0.0)	3(0.5)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	0(0.0)	1(0.5)
514	*Penstemon wilcoxii*	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	5(0.5)	2(0.5)	0(0.0)
522	*Potentilla glandulosa*	5(0.5)	7(0.5)	10(1.8)	0(0.0)	1(3.0)	5(0.5)	4(0.5)	4(0.5)
670	*Potentilla gracilis*	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.5)

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

Genus listing.

(con.)

APPENDIX B-2 (Con.)

	HERB LAYER GROUP	*Epilobium angustifolium*	*Antennaria microphylla*	*Fragaria vesca*	*Lupinus* spp.		*Carex geyeri*		*Calamagrostis rubescens*
	Herb layer type	EPAN -CARU	ANMI -CARU	FRVE -CARU	LUP. -CAGE	LUP. -CARU	CAGE -CAGE	CAGE -CARU	CARU -CARU
	Number of stands	*n* = 2	*n* = 3	*n* = 2	*n* = 2	*n* = 7	*n* = 6	*n* = 12	*n* = 25
*06	*Rumex acetosella*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
681	*Senecio streptanthifolius*	5(0.5)	3(0.5)	0(0.0)	0(0.0)	1(3.0)	0(0.0)	3(0.5)	3(2.6)
541	*Silene menziesii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.5)
542	*Smilacina racemosa*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	4(0.5)	2(0.5)
*08	*Taraxacum officinale*	0(0.0)	3(0.5)	5(0.0)	0(0.0)	4(0.5)	0(0.0)	2(0.5)	2(0.5)
547	*Thalictrum occidentale*	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(3.0)	2(3.8)
*09	*Tragopogon dubius*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.5)	2(0.5)	1(0.5)	1(0.5)
691	*Veratrum californicum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.5)
	Annuals, biennials, and short-lived perennials								
995	Annual	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*11	*Bromus tectorum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
*12	*Cirsium vulgare*	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(3.0)
902	*Collinsia parviflora*	0(0.0)	0(0.0)	5(3.0)	0(0.0)	3(3.0)	3(0.5)	0(0.0)	1(1.8)
903	*Collomia linearis*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
921	*Collomia tenella*	0(0.0)	0(0.0)	0(0 0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
922	*Epilobium minutum*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	1(0.5)	2(0.5)	0(0.0)	1(0.5)
905	*Galium aparine*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
930	*Gayophytum decipiens*	0(0.0)	0(0.0)	0(0.0)	5(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
916	*Gayophytum nuttallii*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
886	*Gnaphalium microcephalum*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
663	*Phacelia hastata* var. *hastata*	0(0.0)	7(0.5)	5(0.5)	5(0.5)	1(0.5)	2(0.5)	0(0.0)	2(0.5)
664	*Phacelia hastata* var. *leucophylla*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
911	*Polygonum douglasii*	0(0.0)	0(0.0)	5(0.5)	5(0.5)	0(0.0)	2(0.5)	0(0.0)	0(0.0)
*16	*Verbascum thapsus*	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.5)
	Misc.								
996	Moss	5(0.5)	10(1.3)	5(0.5)	0(0.0)	3(0.5)	5(0.5)	2(9.0)	2(6.8)
999	Bare soil	0(0.0)	10(17.7)	10(3.0)	10(26.3)	7(24.2)	10(15.0)	2(1.8)	3(17.1)
Years since disturbance	- average:	74	15	12	17	12	18	75	76
	- range:	70-78	8-21	12-13	15-19	6-21	16-26	10-183	4-220

[1]Code to constancy values: + = 0-5%; 1 = >5-15%; 2 = >15-25%; 3 = >25-35%; 4 = >35-45%; 5 = >45-55%; 6 = >55-65%; 7 = >65-75%; 8 = >75-85%; 9 = >85-95%; 10 = >95-100%

* Nonnative species.

APPENDIX C: SUCCESSION CLASSIFICATION FIELD FORM FOR THE DOUGLAS-FIR/PINEGRASS H.T.

(Code Descriptions)

Name:
Plot No.:
Location:
Date:
Livestock effects:
Fire effects: -Age
Scarification effects: -Age

Livestock Effects:

1-Light Cattle Use (palatable species stable)	4-Heavy Sheep Use
2-Heavy Cattle Use	5-Trampling (soil surface exposed)
3-Light Sheep Use	6-None
	7-Other—

Fire Effects:

1-Stand Destroyed	5-Cool Broadcast Burn (soil not exposed)
2-Stand Partially Destroyed	6-Burned Slash Piles
3-Creeping Ground Fire	7-None
4-Hot Broadcast Burn (soil exposed by fire)	8-Other—

Scarification Effects:

1-Heavy (soil well churned)	4-Soil in Piles >18" (from dozer)
2-Light (only duff removed)	5-None
3-Soil Scraped Away	6-Other—

Vegetation Coverage Class:

0-None	3->25 to 50%
T-Rare to 1%	4->50 to 75%
1->1 to 5%	5->75 to 95%
2->5 to 25%	6->95 to 100%

TREES - canopy coverage
Rate coverage by d.b.h. classes:

Code		o. >18"	m. 18-12"	p. 12-4"	s. 4-.1"
001	*Abies grandis*	___	___	___	___
002	*Abies lasiocarpa*	___	___	___	___
010	*Pinus contorta*	___	___	___	___
013	*Pinus ponderosa*	___	___	___	___
014	*Populus tremuloides*	___	___	___	___
016	*Pseudotsuga menziesii*				

SHRUBS - canopy coverage

105	*Amelanchier alnifolia*
150	*Artemisia tridentata*
107	*Ceanothus velutinus*
108	*Chrysothamnus nauseosus*
152	*Chrysothamnus viscidiflorus*
123	*Prunus emarginata*
124	*Prunus virginiana*
125	*Purshia tridentata*
128	*Ribes cereum*
131	*Ribes viscosissimum*
137	*Salix scouleriana*
142	*Spiraea* spp.
143	*Symphoricarpos albus*
163	*Symphoricarpos oreophilus*

PERENNIAL GRAMINOIDS

301	*Agropyron spicatum*
303	*Bromus carinatus*
282	*Bromus inermis*
307	*Calamagrostis rubescens*
309	*Carex geyeri*
311	*Carex rossii*
331	*Poa nervosa*

PERENNIAL HERBS and FERNS

414	*Antennaria microphylla*
415	*Apocynum androsaemifolium*
421	*Arnica cordifolia*
426	*Aster conspicuus*
421	*Balsamorhiza sagittata*
#15	*Castilleja* spp.
459	*Epilobium angustifolium*
465	*Fragaria vesca*
466	*Fragaria virginiana*
470	*Galium triflorum*
473	*Geranium viscosissimum*
833	*Iliamna rivularis*
636	*Lathyrus nevadensis*
499	*Lupinus* spp.
658	*Penstemon attenuatus*
514	*Penstemon wilcoxii*
522	*Potentilla glandulosa*
547	*Thalictrum occidentale*
691	*Veratrum californicum*

ANNUALS, BIENNIALS, and SHORT-LIVED PERENNIALS

*11	*Bromus tectorum*
*12	*Cirsium vulgare*
#56	*Collomia* spp.
914	*Cryptantha* spp.
915	*Descurainia* spp.
904	*Epilobium* spp.
*55	*Galium* spp.
930	*Gayophytum* spp.
886	*Gnaphalium* spp.
*02	*Lactuca serriola*
663	*Phacelia hastata*
911	*Polygonum douglasii*
*16	*Verbascum thapsus*

999	Bare soil

TREE LAYER TYPE	
SHRUB LAYER TYPE	
HERB LAYER TYPE	

APPENDIX D: LIST OF PLANT SPECIES ABBREVIATIONS USED IN THE TEXT

Species	Abbreviation
Trees	
Pinus contorta	PICO
Pinus ponderosa	PIPO
Populus tremuloides	POTR
Pseudotsuga menziesii	PSME
Shrubs	
Amelanchier alnifolia	AMAL
Arctostaphylos uva-ursi	ARUV
Artemisia tridentata	ARTR
Ceanothus velutinus	CEVE
Chrysothamnus nauseosus	CHNA
Chrysothamnus viscidiflorus	CHVI
Linnaea borealis	LIBO
Pachistima myrsinites	PAMY
Prunus emarginata	PREM
Prunus virginiana	PRVI
Purshia tridentata	PUTR
Ribes cereum	RICE
Ribes viscosissimum	RIVI
Salix scouleriana	SASC
Symphoricarpos oreophilus	SYOR
Vaccinium caespitosum	VACA
Graminoids	
Agropyron spicatum	AGSP
Bromus carinatus	BRCA
Bromus inermis	BRIN
Calamagrostis rubescens	CARU
Carex geyeri	CAGE
Carex rossii	CARO
Festuca idahoensis	FEID
Poa nervosa	PONE
Herbs	
Antennaria microphylla	ANMI
Apocynum androsaemifolium	APAN
Arnica cordifolia	ARCO
Aster conspicuus	ASCO
Epilobium angustifolium	EPAN
Fragaria vesca	FRVE
Fragaria virginiana	FRVI
Geranium viscosissimum	GEVI
Iliamna rivularis	ILRI
Lupinus argenteus	LUAR
Lupinus caudatus	LUCA
Lupinus sericeus	LUSE
Penstemon attenuatus	PEAT
Potentilla glandulosa	POGL
Veratrum californicum	VECA

Steele, Robert; Geier-Hayes, Kathleen. 1993. The Douglas-fir/pinegrass habitat type in central Idaho: succession and management. Gen. Tech. Rep. INT-298. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 83 p.

Presents a taxonomic system for classifying plant succession in the Douglas-fir/pinegrass habitat type in central Idaho. A total of 10 potential tree layer types, 32 shrub layer types, and 60 herbaceous layer types are categorized. Diagnostic keys based on indicator species provide for field identification of the types. Discussion of management implications includes pocket gopher populations, success of planted and natural tree seedlings, big-game and livestock forage preferences, and responses of major shrub and herb layer species to disturbance.

KEYWORDS: plant succession, plant communities, forest ecology, forest management, silviculture, classification

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SUCCESSION CLASSIFICATION FIELD FORM FOR THE DOUGLAS-FIR/ PINEGRASS H.T.

(Code Descriptions)

Livestock Effects:
- 1-Light Cattle Use (palatable species stable)
- 2-Heavy Cattle Use
- 3-Light Sheep Use
- 4-Heavy Sheep Use
- 5-Trampling (soil surface exposed)
- 6-None
- 7-Other—

Fire Effects:
- 1-Stand Destroyed
- 2-Stand Partially Destroyed
- 3-Creeping Ground Fire
- 4-Hot Broadcast Burn (soil exposed by fire)
- 5-Cool Broadcast Burn (soil not exposed)
- 6-Burned Slash Piles
- 7-None
- 8-Other—

Scarification Effects:
- 1-Heavy (soil well churned)
- 2-Light (only duff removed)
- 3-Soil Scraped Away
- 4-Soil in Piles >18" (from dozer)
- 5-None
- 6-Other—

Name:	
Plot No.:	
Location:	
Date:	
Livestock effects:	
Fire effects: -Age	
Scarification effects: -Age	

Vegetation Coverage Class:

0-None	3->25 to 50%
T-Rare to 1%	4->50 to 75%
1->1 to 5%	5->75 to 95%
2->5 to 25%	6->95 to 100%

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Rate coverage by d.b.h. classes:

Code		o. >18"	m. 18-12"	p. 12-4"	s. 4-.1"
001	*Abies grandis*	___	___	___	___
002	*Abies lasiocarpa*	___	___	___	___
010	*Pinus contorta*	___	___	___	___
013	*Pinus ponderosa*	___	___	___	___
014	*Populus tremuloides*	___	___	___	___
016	*Pseudotsuga menziesii*				

SHRUBS - canopy coverage

105	*Amelanchier alnifolia*	___
150	*Artemisia tridentata*	___
107	*Ceanothus velutinus*	___
108	*Chrysothamnus nauseosus*	___
152	*Chrysothamnus viscidiflorus*	
123	*Prunus emarginata*	___
124	*Prunus virginiana*	___
125	*Purshia tridentata*	___
128	*Ribes cereum*	
131	*Ribes viscosissimum*	___
137	*Salix scouleriana*	___
142	*Spiraea* spp.	___
143	*Symphoricarpos albus*	___
163	*Symphoricarpos oreophilus*	___
		___

PERENNIAL GRAMINOIDS

301	*Agropyron spicatum*	___
303	*Bromus carinatus*	___
282	*Bromus inermis*	___
307	*Calamagrostis rubescens*	
309	*Carex geyeri*	___
311	*Carex rossii*	___
331	*Poa nervosa*	___
		___

PERENNIAL HERBS and FERNS

414	*Antennaria microphylla*	___
415	*Apocynum androsaemifolium*	___
421	*Arnica cordifolia*	___
426	*Aster conspicuus*	
421	*Balsamorhiza sagittata*	___
#15	*Castilleja* spp.	___
459	*Epilobium angustifolium*	___
465	*Fragaria vesca*	
466	*Fragaria virginiana*	___
470	*Galium triflorum*	___
473	*Geranium viscosissimum*	___
833	*Iliamna rivularis*	
636	*Lathyrus nevadensis*	___
499	*Lupinus* spp.	___
658	*Penstemon attenuatus*	___
514	*Penstemon wilcoxii*	
522	*Potentilla glandulosa*	___
547	*Thalictrum occidentale*	___
691	*Veratrum californicum*	___
		___
		___

ANNUALS, BIENNIALS, and SHORT-LIVED PERENNIALS

*11	*Bromus tectorum*	___
*12	*Cirsium vulgare*	___
#56	*Collomia* spp.	___
914	*Cryptantha* spp.	___
915	*Descurainia* spp.	___
904	*Epilobium* spp.	___
*55	*Galium* spp.	___
930	*Gayophytum* spp.	
886	*Gnaphalium* spp.	___
*02	*Lactuca serriola*	___
663	*Phacelia hastata*	___
911	*Polygonum douglasii*	___
*16	*Verbascum thapsus*	___
999	Bare soil	

TREE LAYER TYPE	
SHRUB LAYER TYPE	
HERB LAYER TYPE	

KEYS TO TREE, SHRUB, AND HERB LAYER TYPES, WITH ADP CODES, IN THE PSME/CARU H. T.

Tree layer

		Code No.
1. *Populus tremuloides* well represented[1]	POTR LAYER GROUP	014
1a. *Populus tremuloides* dominant	POTR-POTR Layer Type	014.014
1b. *Pinus contorta* dominant or codominant	POTR-PICO Layer Type	014.010
1c. *Pinus ponderosa* dominant or codominant	POTR-PIPO Layer Type	014.013
1d. *Pseudotsuga menziesii* dominant or codominant	POTR-PSME Layer Type	014.016
1. *P. tremuloides* poorly represented	2	
2. *Pinus contorta* well represented	PICO LAYER GROUP	010
2a. *Pinus contorta* dominant	PICO-PICO Layer Type	010.010
2b. *Pinus ponderosa* dominant or codominant	PICO-PIPO Layer Type	010.013
2c. *Pseudotsuga menziesii* dominant or codominant	PICO-PSME Layer Type	010.016
2. *P. contorta* poorly represented	3	
3. *Pinus ponderosa* well represented	PIPO LAYER GROUP	013
3a. *Pinus ponderosa* dominant	PIPO-PIPO Layer Type	013.013
3b. *Pseudotsuga menziesii* dominant or codominant	PIPO-PSME Layer Type	013.016
3. *P. ponderosa* poorly represented	4	
4. *Pseudotsuga menziesii* well represented	PSME LAYER GROUP	016
4a. *Pseudotsuga menziesii* dominant	PSME-PSME Layer Type	016.016
4. *P. menziesii* poorly represented	depauperate or undescribed tree layer or not PSME/CARU h.t.	

Shrub layer

		Code No.
1. *Artemisia tridentata* (including *Chrysothamnus*) well represented[1]	ARTR LAYER GROUP	150
1a. *Artemisia* (incl. *Chrysothamnus*) the dominant shrub		
1aa. *Artemisia* (incl. *Chrysothamnus*) coverage greater than *Calamagrostis*	ARTR-ARTR Layer Type	150.150
1ab. *Artemisia* (incl. *Chrysothamnus*) coverage less than or equal to *Calamagrostis*	ARTR-CARU Layer Type	150.307
1b. *Ceanothus* dominant or codominant with *Artemisia* (incl. *Chrysothamnus*)	ARTR-CEVE Layer Type	150.107
1c. *Ribes* spp. dominant or codominant with *Artemisia* (incl. *Chrysothamnus*)	ARTR-RICE Layer Type	150.128
1d. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Artemisia* (incl. *Chrysothamnus*)	ARTR-SYOR Layer Type	150.163
1. *Artemisia* (incl. *Chrysothamnus*) poorly represented	2	
2. *Purshia tridentata* well represented	PUTR LAYER GROUP	125
2a. *Purshia* the dominant shrub		
2aa. *Purshia* coverage greater than *Calamagrostis*	PUTR-PUTR Layer Type	125.125
2ab. *Purshia* coverage less than or equal to *Calamagrostis*	PUTR-CARU Layer Type	125.307
2b. *Ceanothus* dominant or codominant with *Purshia*	PUTR-CEVE Layer Type	125.107
2c. *Ribes* spp. dominant or codominant with *Purshia*	PUTR-RICE Layer Type	125.128
2d. *Salix* dominant or codominant with *Purshia*	PUTR-SASC Layer Type	125.137
2e. *Prunus* spp. dominant or codominant with *Purshia*	PUTR-PRVI Layer Type	125.124
2f. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Purshia*	PUTR-SYOR Layer Type	125.163

(con.)

[1] "Well represented" means canopy coverage ≥5 percent. "Dominant" refers to greatest canopy coverage regardless of height, "codominant" refers to nearly equal canopy coverage. When keying to layer type, choose first condition that fits.

Shrub layer (Con.)

		Code No.
2. *Purshia* poorly represented	3	
3. *Ceanothus velutinus* well represented	CEVE LAYER GROUP	107
3a. *Ceanothus* the dominant shrub		
3aa. *Ceanothus* coverage greater than *Calamagrostis*	CEVE-CEVE Layer Type	107.107
3ab. *Ceanothus* coverage less than or equal to *Calamagrostis*	CEVE-CARU Layer Type	107.307
3b. *Ribes* spp. dominant or codominant with *Ceanothus*	CEVE-RICE Layer Type	107.128
3c. *Salix* dominant or codominant with *Ceanothus*	CEVE-SASC Layer Type	107.137
3d. *Prunus* spp. dominant or codominant with *Ceanothus*	CEVE-PRVI Layer Type	107.124
3e. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Ceanothus*	CEVE-SYOR Layer Type	107.163
3. *Ceanothus* poorly represented	4	
4. *Ribes* spp. (mainly *R. cereum*) well represented	RICE LAYER GROUP	128
4a. *Ribes* spp. the dominant shrub		
4aa. *Ribes* spp. coverage greater than *Calamagrostis*	RICE-RICE Layer Type	128.128
4ab. *Ribes* spp. coverage less than or equal to *Calamagrostis*	RICE-CARU Layer Type	128.307
4b. *Salix* dominant or codominant with *Ribes*	RICE-SASC Layer Type	128.137
4c. *Prunus* spp. dominant or codominant with *Ribes*	RICE-PRVI Layer Type	128.124
4d. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Ribes*	RICE-SYOR Layer Type	128.163
4. *Ribes* poorly represented	5	
5. *Salix scouleriana* well represented	SASC LAYER GROUP	137
5a. *Salix* the dominant shrub		
5aa. *Salix* coverage greater than *Calamagrostis*	SASC-SASC Layer Type	137.137
5ab. *Salix* coverage less than or equal to *Calamagrostis*	SASC-CARU Layer Type	137.307
5b. *Prunus* spp. dominant or codominant with *Salix*	SASC-PRVI Layer Type	137.124
5c. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Salix*	SASC-SYOR Layer Type	137.163
5. *Salix* poorly represented	6	
6. *Prunus virginiana* (incl. *P. emarginata*) well represented	PRVI LAYER GROUP	124
6a. *Prunus* spp. the dominant shrub		
6aa. *Prunus* coverage greater than *Calamagrostis*	PRVI-PRVI Layer Type	124.124
6ab. *Prunus* coverage less than or equal to *Calamagrostis*	PRVI-CARU Layer Type	124.307
6b. *Symphoricarpos* (incl. *Amelanchier*) dominant or codominant with *Prunus*	PRVI-SYOR Layer Type	124.163
6. *Prunus* spp. poorly represented	7	
7. *Symphoricarpos oreophilus* (incl. *Amelanchier*) well represented	SYOR LAYER GROUP	163
7a. *Symphoricarpos* (incl. *Amelanchier*) coverage greater than *Calamagrostis*	SYOR-SYOR Layer Type	163.163
7b. *Symphoricarpos* (incl. *Amelanchier*) coverage less than or equal to *Calamagrostis*	SYOR-CARU Layer Type	163.307
7. *Symphoricarpos* (incl. *Amelanchier*) poorly represented	depauperate or unclassified shrub-layer	

(con.)

Herb layer

		Code No.
1. Annuals, biennials, and short-lived perennials (see layer group description for species) well represented[1] either individually or collectively	ANNUALS LAYER GROUP	900
1a. The above species dominant	ANN.-ANN. Layer Type	900.900
1b. *Bromus carinatus* (incl. *Bromus inermis*) dominant or codominant	ANN.-BRCA Layer Type	900.303
1c. *Potentilla glandulosa* (incl. *Carex rossii* and *Iliamna rivularis*) dominant or codominant	ANN.-POGL Layer Type	900.522
1d. *Geranium viscosissimum* (incl. *Penstemon attenuatus*) dominant or codominant	ANN.-GEVI Layer Type	900.473
1e. *Epilobium angustifolium* dominant or codominant	ANN.-EPAN Layer Type	900.459
1f. *Antennaria microphylla* dominant or codominant	ANN.-ANMI Layer Type	900.414
1g. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	ANN.-APAN Layer Type	900.415
1h. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	ANN.-FRVE Layer Type	900.465
1i. *Lupinus* spp. dominant or codominant	ANN.-LUP. Layer Type	900.499
1j. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	ANN.-CAGE Layer Type	900.309
1k. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	ANN.-CARU Layer Type	900.307
1. Annuals, biennials, and short-lived perennials poorly represented	2	
2. *Bromus carinatus* (incl. *B. inermis*) well represented	BRCA LAYER GROUP	303
2a. The above species dominant	BRCA-BRCA Layer Type	303.303
2b. *Potentilla glandulosa* (incl. *Carex rossii* and *Iliamna rivularis*) dominant or codominant	BRCA-POGL Layer Type	303.522
2c. *Geranium viscosissimum* (incl. *Penstemon attenuatus*) dominant or codominant	BRCA-GEVI Layer Type	303.473
2d. *Epilobium angustifolium* dominant or codominant	BRCA-EPAN Layer Type	303.459
2e. *Antennaria microphylla* dominant or codominant	BRCA-ANMI Layer Type	303.414
2f. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	BRCA-APAN Layer Type	303.415
2g. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	BRCA-FRVE Layer Type	303.465
2h. *Lupinus* spp. dominant or codominant	BRCA-LUP. Layer Type	303.499
2i. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus)* dominant or codominant	BRCA-CAGE Layer Type	303.309
2j. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	BRCA-CARU Layer Type	303.307
2. *Bromus carinatus* (incl. *B. inermis*) poorly represented	3	
3. *Potentilla glandulosa* (incl. *Carex rossii* and *Iliamna rivularis*) well represented	POGL LAYER GROUP	522
3a. The above species dominant	POGL-POGL Layer Type	522.522
3b. *Geranium viscosissimum* (incl. *Penstemon attenuatus*) dominant or codominant	POGL-GEVI Layer Type	522.473
3c. *Epilobium angustifolium* dominant or codominant	POGL-EPAN Layer Type	522.459

(con.)

Herb layer (Con.)

		Code No.
3d. *Antennaria microphylla* dominant or codominant	POGL-ANMI Layer Type	522.414
3e. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	POGL-APAN Layer Type	522.415
3f. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	POGL-FRVE Layer Type	522.465
3e. *Lupinus* spp. dominant or codominant	POGL-LUP. Layer Type	522.499
3g. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	POGL-CAGE Layer Type	522.309
3h. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	POGL-CARU Layer Type	522.307
3. *Potentilla glandulosa* (incl. *Carex rossii* and *Iliamna rivularis*) poorly represented	4	
4. *Geranium viscosissimum* (incl. *Penstemon attenuatus*) well represented	GEVI LAYER GROUP	473
4a. The above species dominant	GEVI-GEVI Layer Type	473.473
4b. *Epilobium angustifolium* dominant or codominant	GEVI-EPAN Layer Type	473.459
4c. *Antennaria microphylla* dominant or codominant	GEVI-ANMI Layer Type	473.414
4d. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	GEVI-APAN Layer Type	473.415
4e. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	GEVI-FRVE Layer Type	473.465
4f. *Lupinus* spp. dominant or codominant	GEVI-LUP. Layer Type	473.499
4g. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	GEVI-CAGE Layer Type	473.309
4h. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	GEVI-CARU Layer Type	473.307
4. *Geranium viscosissimum* (incl. *Penstemon attenuatus*) poorly represented	5	
5. *Epilobium angustifolium* well represented	EPAN LAYER GROUP	459
5a. The above species dominant	EPAN-EPAN Layer Type	459.459
5b. *Antennaria microphylla* dominant or codominant	EPAN-ANMI Layer Type	459.414
5c. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	EPAN-APAN Layer Type	459.415
5d. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	EPAN-FRVE Layer Type	459.465
5e. *Lupinus* spp. dominant or codominant	EPAN-LUP. Layer Type	459.499
5f. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	EPAN-CAGE Layer Type	459.309
5g. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	EPAN-CARU Layer Type	459.307
5. *Epilobium angustifolium* poorly represented	6	
6. *Antennaria microphylla* well represented.	ANMI LAYER GROUP	414
6a. The above species dominant	ANMI-ANMI Layer Type	414.414
6b. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) dominant or codominant	ANMI-APAN Layer Type	414.415
6c. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	ANMI-FRVE Layer Type	414.465
6d. *Lupinus* spp. dominant or codominant	ANMI-LUP. Layer Type	414.499
6e. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	ANMI-CAGE Layer Type	414.309

(con.)

Herb layer (Con.)

		Code No.
6f. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	ANMI-CARU Layer Type	414.307
6. *Antennaria microphylla* poorly represented	7	
7. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) well represented	APAN LAYER GROUP	415
7a. The above species dominant	APAN-APAN Layer Type	415.415
7b. *Fragaria vesca* (incl. *F. virginiana*) dominant or codominant	APAN-FRVE Layer Type	415.465
7c. *Lupinus* spp. dominant or codominant	APAN-LUP. Layer Type	415.499
7d. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	APAN-CAGE Layer Type	415.309
7e. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	APAN-CARU Layer Type	415.307
7. *Apocynum androsaemifolium* (incl. *Veratrum californicum*) poorly represented	8	
8. *Fragaria vesca* (incl. *F. virginiana*) well represented	FRVE LAYER GROUP	465
8a. The above species dominant	FRVE-FRVE Layer Type	465.465
8b. *Lupinus* spp. dominant or codominant	FRVE-LUP. Layer Type	465.499
8c. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	FRVE-CAGE Layer Type	465.309
8d. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	FRVE-CARU Layer Type	465.307
8. *Fragaria vesca* (incl. *F. virginiana*) poorly represented	9	
9. *Lupinus* spp. well represented	LUP. LAYER GROUP	499
9a. The above species dominant	LUP.-LUP. Layer Type	499.499
9b. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) dominant or codominant	LUP.-CAGE Layer Type	499.309
9c. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	LUP.-CARU Layer Type	499.307
9. *Lupinus* spp. poorly represented	10	
10. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) well represented	CAGE LAYER GROUP	309
10a. The above species dominant	CAGE-CAGE Layer Type	309.309
10b. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) dominant or codominant	CAGE-CARU Layer Type	309.307
10. *Carex geyeri* (incl. *Poa nervosa* and *Aster conspicuus*) poorly represented	11	
11. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) well represented	CARU LAYER GROUP	307
11a. The above species dominant	CARU-CARU Layer Type	307.307
11. *Calamagrostis rubescens* (incl. *Arnica cordifolia* and *Antennaria racemosa*) poorly represented	depauperate or unclassified layer type	

INTERMOUNTAIN RESEARCH STATION

The Intermountain Research Station provides scientific knowledge and technology to improve management, protection, and use of the forests and rangelands of the Intermountain West. Research is designed to meet the needs of National Forest managers, Federal and State agencies, industry, academic institutions, public and private organizations, and individuals. Results of research are made available through publications, symposia, workshops, training sessions, and personal contacts.

The Intermountain Research Station territory includes Montana, Idaho, Utah, Nevada, and western Wyoming. Eighty-five percent of the lands in the Station area, about 231 million acres, are classified as forest or rangeland. They include grasslands, deserts, shrublands, alpine areas, and forests. They provide fiber for forest industries, minerals and fossil fuels for energy and industrial development, water for domestic and industrial consumption, forage for livestock and wildlife, and recreation opportunities for millions of visitors.

Several Station units conduct research in additional western States, or have missions that are national or international in scope.

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Bozeman, Montana (in cooperation with Montana State University)

Logan, Utah (in cooperation with Utah State University)

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